Final

Remedial Investigation FWA 102 Former Communications Site, Fort Wainwright, Alaska

Prepared for

U.S. Army Garrison, Fort Wainwright, Alaska

Under U.S. Army Corps of Engineers, Alaska District, Contract No. W911KB-05-D-0010
Task Order 13

December 2010

CH2MHILL
949 E. 36th Avenue, Suite 500
Anchorage, AK 99508

Executive Summary

This report presents the findings of the remedial investigation (RI) conducted at the Former Communications Site (FCS), also known as Taku Gardens family housing development on Fort Wainwright, Alaska. This area was designated as Operable Unit 6 (OU 6) in the Fort Wainwright Federal Facilities Agreement (FFA). The purpose of the RI is to provide a comprehensive evaluation of environmental conditions at the FCS to determine the nature and extent of contamination, assess potential risks posed by exposure where contamination exists, and support management decisions to protect human health and the environment.

The information provided in this report demonstrates that the Army has conducted an extensive environmental investigation at the FCS and, as a result, now understands the nature and extent of contamination remaining at the site, the potential for human and ecological receptors to be exposed to this contamination, and the current and future risks associated with such exposure. The results indicate that, based on the available data and using health-conservative exposure assumptions, no unacceptable risk is identified under reasonably anticipated future land and water use conditions at the FCS.

Site Description

The FCS is located between Alder and Neely roads, east of White Street and west of the Fort Wainwright Power Plant. The Taku Gardens Family Housing development covers 54 acres of the FCS and includes 110 new housing units (in 55 buildings). The buildings are intended for use as family housing for Fort Wainwright military personnel and their families but are currently unoccupied.

The area historically defined as the FCS has a history of mixed uses, including the following:

- Equipment salvage and reclamation
- Debris and salvage material disposal in the Chena River oxbow that extends through the site, in trenches in the salvage yard area, and possibly in other local depressions
- Barracks and company headquarters, extending into the northwest corner of the site
- Garden plots
- Communications and radar systems
- Possible ammunition storage

A limited number of written records describing specific activities occurring at the FCS during the course of its use are available. Much of what is known about the FCS has been inferred from examining and comparing historical photographs (dating from 1947 to the present), the 1958 Fort Wainwright “Master Plans,” past geographical surveys, and military operations concurrent with similar missions conducted at other locations.

The area was selected for military family housing in 2002 and 2003. Preconstruction geotechnical samples were collected in late 2003 and again in 2004. Geophysical testing completed during this time indicated areas of buried debris near the former salvage yard. Work began on the Taku Gardens Family Housing development in mid-2005, with the installation of foundations and underground utilities necessary for the construction of the 65 residential buildings and two mechanical buildings.

The majority of the 110 housing units in the 55 completed buildings have been completely finished, with the exception of the installation of major appliances. The contractor has winterized the units by activating the electrical systems, steam mains, and glycol heat exchangers. The 20 additional housing units in the southwestern portion of the FCS (Buildings 50 through 59)[1] will not be completed; their partially installed foundations were removed in 2009.

Plate 1, a foldout map at the front of this document, shows the layout of the Taku Gardens family housing development and other nearby features.

Investigation Activities

Investigation of the FCS began in 2003, following selection of the land for construction of future military housing. Initial investigations, which included geophysical, geotechnical, and some subsurface-soil-sampling components, were intended to support construction activities. During these early investigations, the first indications of buried debris, munitions-related items, and contaminated soils were identified at the FCS. Soil contamination included polychlorinated biphenyls (PCBs), which were discovered in the southwest corner of the FCS, and petroleum, oil, and lubricants (POL), which were found in the vicinity of Buildings 5 through 9.

Section 2 of this report presents a summary of the FCS history, a chronology of preliminary investigation activities, and the key conclusions resulting from the preliminary (pre-RI) investigations, which led the U.S. Army, the U.S. Environmental Protection Agency (EPA), and Alaska Department of Environmental Conservation (ADEC) to conduct a comprehensive RI to characterize known and suspected contamination of soil, groundwater, and other environmental media at the FCS.

The RI field activities were conducted between 2007 and 2010 and followed the RI Management Plan and amendments, as well as work plan addenda presented in technical memoranda that were submitted following interim evaluations of analytical results for samples collected in 2007 and 2008. The work focused on the following tasks:

- **PCB Investigation/Removal Activities:** Excavation and disposal of PCB-contaminated soils at the Building 52 area and other localized areas of contamination across the FCS. Over 5,500 yd^3 of PCB-contaminated soil was generated, characterized, and properly disposed of during these investigations.
- **Contaminated-Soil Investigations:** Investigation and delineation of contaminated soil associated with releases of petroleum, pesticides, and other chemicals. Over 120 yd^3 of petroleum- and pesticide-contaminated soil was generated, characterized, and properly disposed of during these investigations.

[1] The building numbers used in this report are those used in construction planning and are not the same as the physical addresses of the now-constructed buildings.

- **Drum and Debris Investigation:** Investigation, removal, and disposal of buried drums, debris, and munitions-related items that were identified through geophysical surveys and disposal of any contaminated soil that coincided with the buried debris at 13 large excavations and several smaller excavations. The drum and debris investigation excavations covered a total of 7.5 acres of the FCS. Large volumes of metal debris and 1,058 mostly crushed and empty drums were found in the excavations, and 1,500 yd^3 of contaminated soil was generated, characterized, and properly disposed of during the investigations.
- **Excavation Confirmation Sampling:** Sampling of excavation sidewalls and bottoms following removal of buried drums; debris; munitions-related items; and PCB-, petroleum-, and pesticide-contaminated soils to determine whether any soil contamination remained after the excavation.
- **Soil Characterization:** Installation and sampling of soil borings across the FCS to evaluate site-wide surface and subsurface soil conditions and completion of the borings as groundwater monitoring wells to evaluate groundwater conditions and delineate contaminant plumes at the FCS. In total, 77 soil borings were drilled and sampled. An additional 87 surface soil samples were also collected to fill in areal coverage across the FCS. Surface soil samples were also obtained from the earthen sound berm that extends around the south and southeast portions of the FCS and that was constructed from soil generated during site-clearing and construction activities. Together with the soil characterization and excavation confirmation samples identified above, over 3,500 surface and subsurface soil samples have been collected at the FCS.
- **Groundwater Characterization:** Thirteen monitoring wells were installed at the site prior to the RI. Seventy-two additional shallow monitoring wells and four deep monitoring wells were installed during the RI, bringing the total number of wells at the FCS to 89. (Note that the current number of wells at the FCS is 88 because MW-07 was decommissioned in 2009 to allow for excavation near Buildings 15 and 17.) All wells, with the exception of MW06b (MW06a was sampled instead), have been sampled at least once, and up to five rounds of groundwater sampling have been conducted at wells located within or adjacent to identified source areas and/or contaminant plumes, or in the vicinity of the Fort Wainwright (FWA) water supply wells.
- **Hydrogeological Investigation:** Identification of the groundwater flow direction at the FCS and estimation of the capture zones for the FWA water supply wells that are located in Building 3559, just east of the FCS.
- **Soil Gas Investigation:** Installation and sampling of 110 subslab soil-gas probes (one in each housing unit garage) and 53 vadose zone soil-gas probes in open areas of the FCS to characterize soil gas and evaluate the potential for contaminants to affect indoor and outdoor air.
- **Geophysical Surveys:** Geophysical surveys were conducted in 2007 to guide the drum and debris investigations and in 2009 to document final excavation conditions following investigation and removal of buried materials.

- **Drainage Swale Sampling:** Collection of sediment samples from two main FCS drainage swales to identify any contamination that could pose risk to terrestrial and downstream aquatic wildlife.
- **Soil Pile Sampling and Inspection:** Characterization of the soil piles created during the housing foundation and utility trench excavation activities to determine the types of debris, munitions-related items, and contamination present and to facilitate proper disposal; this was followed by sampling of the surface soil remaining after removal and disposal of soil piles to determine whether the soil underlying the piles had been impacted by contaminants in the piles.

Preliminary Conceptual Site Model

Preliminary site investigations initially divided the FCS into five subareas (Subareas A through E) based on the historical usage, review of historical aerial photographs and maps, and the types of contamination and debris encountered. The subareas are described below:

- **Subarea A** consisted of the northeast quadrant of the housing development, where buried debris containing munitions-related items was identified.
- **Subarea B** was located along the northern boundary of the development, where company headquarters and barracks buildings were constructed over a filled former oxbow of the Chena River named Hoppe's Slough and where petroleum contamination was identified during preliminary investigations.
- **Subarea C** was located along the northeastern corner of the development, where company headquarters and barracks buildings were constructed over Hoppe's Slough.
- **Subarea D** consisted of the southeast corner of the development that was part of a salvage yard in the 1940s, was potentially used for ammunition storage in the 1950s, and where the Golden Valley Electric Association station was constructed in the late 1970s.
- **Subarea E** was the southwest corner of the development and consisted of land that housed communications operations in the 1950s, but was cleared and used for personal gardens through the late 1990s. During initial construction activities, soil in the area was found to be contaminated with PCBs. The partially installed foundations and partially installed utilities for the additional 20 housing units in 10 buildings (Buildings 50 through 59) in this area were not completed, and the foundations were removed in 2009.

With the exception of PCB contamination in Subarea E and the presence of munitions-related items intermixed with debris in Subarea A, further investigation and data evaluations conducted in support of this RI have determined that the initial subareas do not constitute distinct sources or zones of contamination and are useful only as general geographic references.

The preliminary conceptual site model (CSM) for contamination presented in the RI Management Plan guided how the FCS was investigated and the nature and extent of contamination were evaluated. CSM hypotheses were tested, refined, and modified during the RI and included the following elements related to the sources, nature and extent of contamination, transport and exposure media, and exposure pathways and receptors at the FCS:

- **Sources:** Potential primary contaminant sources at the FCS include leaks from heating fuel tanks or pipelines used at headquarters and barracks, disposal of scrap metal and munitions-related items at the former salvage yard, burial of drums of waste oil and chemicals, discharge of transformer oil, and chemicals spilled during possible firefighter-training activities. The majority of such sources, as well as contaminated soil that may have acted as a secondary source, was found in discrete, localized areas (e.g., PCBs in Subarea E and former transformer locations and drums and debris in filled low-lying areas near the former salvage yard in Subarea A). Such sources were eliminated during the course of Taku Gardens subdivision development and completion of the RI.
- **Release and Transport Mechanisms:** Release and transport mechanisms for site contaminants include surface runoff and overland flow (from spring thawing or flooding), physical soil movement (excavation and accidental and deliberate movement), fugitive dust emission, volatilization, leaching to groundwater, construction dewatering activities, and breakdown resulting from biodegradation and mixture with other chemicals
- **Transport and Exposure Media:** Surface soil, subsurface soil, groundwater, and soil gas were identified as possible transport and exposure media for contaminants.
- **Potentially Complete Human Exposure Pathways and Receptors:** On the basis of current understanding of land and water beneficial use conditions at or near the FCS, the most plausible exposure scenarios considered for characterizing human health risks include future maintenance workers, future excavation workers, future recreational/site visitors, and future residents. However, a hypothetical future unrestricted exposure scenario is also considered to evaluate the no action scenario.
- **Potentially Complete Ecological Exposure Pathways and Receptors:** Plausible ecological exposure pathways considering the chemicals of potential concern (COPCs),[2] available habitat, and available food sources at the FCS consist of potential exposures of aquatic resources and piscivorous (fish-eating) wildlife to chemicals in groundwater that could reach the Chena River, potential exposure of terrestrial wildlife (mammals and birds) to site-related chemicals in sediment from drainage swales adjacent to the FCS, and hypothetical exposure of benthic macroinvertebrates to drainage swale sediments that could be migrating to the Chena River.

Nature and Extent of Contamination

The nature and extent of contamination evaluation consists of a characterization of contaminant sources identified at the FCS and an assessment of the nature and extent of residual contamination remaining in soil, groundwater, and soil gas at the FCS.

[2] COPCs are those chemicals that are carried through the risk quantification process, and take into consideration identification of detected chemicals, background concentrations, essential nutrients, and availability of toxicity factors.

The evaluations rely on conservative screening levels (referred to in this report as project screening levels [PSLs]) to identify chemicals of interest (COIs)[3] and determine the extent of contamination. The PSLs are based primarily on 2009 ADEC Method 2 cleanup levels[4] and background (as appropriate). EPA Regional Screening Levels[5] were used for analytes that did not have Method 2 cleanup levels. Although most of the PSLs are derived by using health-conservative exposure-based assumptions, their use in this report is solely to provide a perspective for identifying the nature and extent of contamination, and they are not intended to infer the existence of unacceptable risk. Rather, the risk assessment conducted as part of this RI provides site-specific estimates of risk intended for management decision-making.

Source Characterization

The approach for the source characterization evaluation consisted of compiling and reviewing information about the materials found in the subsurface during construction activities, drum and debris investigations, and removal of contaminated soil. Although primarily a qualitative evaluation, analytical data for samples of soil and waste recovered during these activities were also compiled to provide a rough characterization of the materials that may have acted as primary or secondary sources of contaminants prior to discovery, removal, and disposal as investigation-derived waste (IDW) during the RI.

The following summarizes the buried debris and materials encountered in the subsurface at different locations around the FCS. The locations of areas where buried debris and materials were encountered are described by the nearest buildings or site feature:

- **Near Buildings 15 and 17:** One hundred fifteen drums (mostly crushed and empty, although a few contained residual amounts of a fuel-water mixture or tar), furnaces with potential asbestos-containing material (ACM), transformers, lead-acid batteries, charcoal, paint cans, munitions-related items,[6] 238 yd^3 of contaminated soil, 538 munitions debris (MD), and one discarded military munition (DMM).
- **Near Buildings 22 and 24:** Thirty-nine crushed and empty drums (a few containing an oily mixture), furnaces with potential ACM, transformers, a crushed fuel tank, lead-acid batteries, paint cans, empty compressed-gas cylinders, fire extinguishers, hydraulic cylinders with hydraulic oil, metals debris, shipping containers for spent artillery shells, DMM and 1,552 other MD items (e.g., practice/inert projectiles and rockets, rocket motors, dummy fuzes, and cartridge cases), and 34 yd^3 of contaminated soil.
- **Near Building 48:** Drums (mostly crushed and empty, although a few contained tar/asphalt residue, one had liquid containing degraded gasoline, one had white

[3] COIs are those chemicals with one or more exceedances of the project screening levels, which are conservative risk-based values used to evaluate the nature and extent of contamination at the FSC.

[4] The ADEC Method 2 cleanup levels are based on an excess lifetime cancer risk (ELCR) of 1×10^{-5} and a hazard index (HI) of 1, consequently the ADEC values for direct contact and outdoor inhalation listed in Tables B1/B2 and for groundwater ingestion in Table C were divided by 10 prior to selection of the lowest applicable value. Although migration to groundwater cleanup levels were not used as PSLs, soil in areas where migration to groundwater cleanup levels are exceeded would be considered contaminated if excavated and would not be usable for fill in areas where surface water is present.

[5] The residential RSLs for noncarcinogenic chemicals are based on a HI of 1. Therefore, to account for possible cumulative risk associated with multiple chemical exposures, the listed RSLs for noncarcinogens were divided by 10.

[6] "Munitions-related items" is used in this report as a general term to describe munitions debris, range-related debris, and discarded military munitions found at the FCS and later classified according to the DOD-specified terms.

residue, and one contained an unspecified liquid), a fuel bladder, cables, transformers, lead-acid battery plates, scrap metal, empty compressed-gas cylinders, DMM and other munitions-related items, and 150 yd^3 of contaminated soil.

- **Near Building 49:** Forty-five drums (mostly crushed and empty, although a few contained tar/asphalt material or degraded fuel), paint cans, metal debris, rubber bladders, concrete, burnt wood, and 3 yd^3 of contaminated soil (no munitions-related items were found).
- **Former Subarea D:** Four hundred fifteen crushed and empty drums, two drums with residual oil, 2 yd^3 of paint-contaminated soil, and three MDs.
- **>75-mV Anomalies:**[7] The following items were found during the 2008 investigation of the 75-mV anomalies:
  - **Near Building 11:** Ten crushed drums with residual tar and 336 yd^3 of soil with a burned appearance
  - **Near Building 12:** Four crushed and empty drums, lead-acid battery plates, and 24 yd^3 of creosote-coated lumber and surrounding soil
  - **Near Building 16:** Scrap metal (mostly banding)
  - **Near Building 26:** One crushed and empty drum, airplane engine parts, and 465 yd^3 of burned soil with small pieces of metal debris
  - **Near Buildings 28 and 31:** Miscellaneous metal debris, 60 yd^3 of fuel-contaminated soil, and six munitions-related items, with a 3.5-inch M29 practice rocket with live motor, classified as DMM
- **<75-mV Anomalies**. Only utilities and minor amounts of surface metal debris; no drums, canisters or other possible source of contamination were identified.
- **PCB Interim Removal Action and Hot Spot Investigations:** An interim removal action of PCB-contaminated soil occurred in the Building 52 area in 2007. This removal action was followed by additional investigation of PCB-contaminated soil in the same area during 2008. Smaller PCB hot spot investigations also took place around Subarea E and in the Transformer Service Area during 2007. Several items relating to power generation, historically associated with the FCS area, were removed during the investigations, including copper wire, ceramic sections of transformers, and power poles. Samples collected from the floor and sidewalls of the excavations demonstrated that the PCB-contaminated soil had been adequately delineated, with all contaminated soil removed incidental to the investigation.
- **Heating-Oil Spill Investigations:** Small heating-oil spills discovered in front of approximately 40 houses during construction activities at the FCS were reported in 2005. However, no survey data to identify the exact locations of these hot spots were produced; therefore, in 2008 an inspection was conducted to identify stained soil and

[7] Geophysical evidence and results from the 2007 investigation suggested that anomalies with an EM61 result of 75 mV and above represent what could be an area containing drums of hazardous materials or waste, munitions-related items, or other large debris. Anomalies below 75 mV were considered to represent smaller items rather than large masses of metal debris.

zones of elevated PID readings. Of the 40 areas where spills had potentially occurred, stained soil with elevated PID readings was encountered only at Buildings 9, 40, and 45. Samples collected from the floor and sidewalls of the excavation demonstrated that the heating oil spills had been adequately delineated, with all contaminated soil removed incidental to the investigation.

- **POL Investigation North of Building 9:** On July 7, 2009, field personnel reported fuel odors during grading activities north of Buildings 9 and 11. This area coincided with where a pipe had been removed in 2008, and the odors appeared to be related to the POL-contaminated soil that was partially excavated from the Building 5 through 9 area during building construction in 2005 (excavation of POL-contaminated soil was limited to the portion of the FCS being developed for housing; the 2009 POL investigation picked up where the construction-related excavation left off). The lateral extent of POL contamination was determined through test pitting, and it was determined that contamination had migrated approximately 40 feet northwest of the apparent source. Materials encountered in the excavation included a variety of abandoned pipes. Samples collected from the floors and sidewalls of the excavation demonstrated that the POL-contaminated soils had been adequately delineated. Approximately 1,092 cubic yards of soil were removed from the excavation during delineation.

- **DDT Hot Spot Excavation near Building 11:** An evaluation of historical sample results was undertaken as part of planning for 2008 RI activities. This evaluation identified one historical surface soil sample location near Building 11 with a DDT concentration that exceeded the screening criterion by more than 10 times. The Building 11 DDT hot spot was investigated further in 2008. Samples collected from the floor and sidewalls of the excavation demonstrated that the DDT hot spot had been adequately delineated, with all contaminated soil (approximately 15 yd^3) removed incidental to the investigation.

- **DDT Hot Spot Excavation near Building 19:** An evaluation of confirmation sample results from 2009 was undertaken as part of the nature and extent and risk assessment evaluations. This evaluation identified a surface soil sample from the eastern portion of the Building 15/17 backfilled excavation near Building 19 with a DDT concentration greater than 10 times the screening criterion. The 2009 DDT hot spot was investigated further in April 2010. Samples were collected from the base of the excavation and from sidewalls composed of native soil (i.e., backfill was not sampled). Sample results demonstrated that the DDT hot spot had been adequately delineated, with all contaminated soil (approximately 51 yd^3) removed incidental to the investigation.

The ex situ soil and waste characterization samples from the excavations and investigations described above provide a rough approximation of the types of chemicals that might have been used, released, or disposed of at the FCS in the past. The more frequently detected organic chemicals in this sample group consist of PCBs, petroleum hydrocarbons (diesel range organics [DRO], residual range organics [RRO], and gasoline range organics [GRO]) and associated volatile organic compounds (VOCs) and polynuclear aromatic hydrocarbons (PAHs), chlorinated VOCs, pesticides, and explosives, distributed as follows:

- **PCBs:** As with the focus of PCB removal actions, the ex situ soil and waste samples with the highest concentrations of PCBs (up to 120,000 mg/kg) were collected from soils near or in stockpiles associated with Building 52 and the PCB Exclusion Zone (EZ). All PCB-contaminated soil characterized with concentrations exceeding 1 mg/kg has been removed from the FCS, either as a result of IDW disposal or an interim removal action.

- **Petroleum Hydrocarbons:** Waste samples with the highest concentrations of petroleum (up to 120,000 mg/kg DRO) were taken from drums containing residual oily material or tar, whereas soil samples with the highest concentrations of DRO (up to 22,300 mg/kg) and petroleum-related VOCs and PAHs were collected from now-excavated subsurface soils and soil piles in the vicinity of Buildings 7 and 9.
- **Pesticides:** Pesticide detections were scattered throughout soil piles and the now-excavated soils at FCS. With the exception of two DDT hot spots, the detected concentrations were below the PSL and landfill waste acceptance criteria and appear to be consistent with routine application of the chemicals for insect and weed control.
- **Explosives:** Soil pile and other waste characterization samples collected in Subarea A were analyzed for explosive constituents due to the presence of munitions-related items. Low concentrations of explosives were detected in several of these samples, but concentrations of these chemicals were below PSLs and landfill waste acceptance criteria.
- Chlorinated VOCs, such as trichloroethene (TCE) and tetrachloroethene (PCE), were detected in fewer than 3 percent of the ex situ soil and waste samples analyzed for VOCs.

Nature and Extent of Residual Contamination

The approach of the nature and extent of contamination evaluation included comparing analytical data for samples collected across the FCS to the PSLs[8] to determine which chemicals exceeded those levels in surface soil, subsurface soil, groundwater, and soil gas, and then evaluating the distributions of the identified COIs in FCS media. Since many of the COIs are related to particular types of chemicals or fuels, they were grouped together in the distribution analyses below:

- **PCBs:** Aroclor 1260 was identified as a COI on the basis of a single exceedance of the 1 mg/kg PSL in subsurface soil. This single exceedance occurred in a floor of an excavation sample at a depth of 12.5 feet bgs. The affected soil was reportedly removed; however, a sample could not be collected to confirm the removal because groundwater entered the excavation. A monitoring well was installed at this location in 2008 to gauge the potential for PCBs in groundwater at this location. None of the soil samples collected from the borehole nor the groundwater sample collected at the well contained concentrations of PCBs above the PSLs.
- **Petroleum and Petroleum-Related Chemicals:** One exceedance of the PSL for GRO was identified in surface soil. The level of GRO in the sample was below the ADEC Method 2 cleanup level, and no other exceedances of PSLs for other COIs were identified in the sample. DRO, GRO, and RRO were detected above their PSLs in several subsurface soil samples collected at the FCS. The DRO exceedances occur primarily in the north-central

[8] PSLs for soil are based on regulatory levels for exposure through direct contact and outdoor inhalation. PSLs for groundwater are based on regulatory levels for drinking water exposure.

portion of FCS where petroleum contamination was identified during pre-RI investigations. The highest concentrations of DRO occurred at depths of 12 to 16 feet bgs, depths that are unlikely to have been reached during removal of the contaminated soil. The RRO and GRO exceedances are scattered around the FCS and the levels of these COIs were below the ADEC Method 2 cleanup level, with no other coinciding PSL exceedances in the samples. Monitoring wells with elevated concentrations of DRO are located in the north-central portion of the FCS, where petroleum-affected groundwater was suspected and petroleum-contaminated soil was removed. Consistent with the general groundwater flow direction, the petroleum-affected zone extends northward and was delineated by wells installed as part of the 2009 northern plume investigation. Petroleum hydrocarbons in the form of RRO were reported at concentrations above the PSL in groundwater samples obtained from several monitoring wells during the fall 2007 monitoring event. Most exceedances occurred in wells outside the petroleum-affected area, and the reported concentrations in the wells were below the MDL for that event and J qualified. Similar results were not reported during subsequent sampling events. Regardless, all RRO exceedances were less than the ADEC Method 2 cleanup level, and the extent of the RRO-affected groundwater is bounded by the existing monitoring-well network. A few scattered exceedances of the PSLs for naphthalene co-occur with the petroleum-affected soil and groundwater (e.g., SG007-L and SG071) but, for the most part, soil-gas PSL exceedances for petroleum-related VOCs are isolated and unrelated to conditions in soil and groundwater.

- **PAHs:** Three exceedances of the PSL for benzo(a)pyrene were identified in surface soil. The levels of benzo(a)pyrene in the samples were below the ADEC Method 2 cleanup level, and no other exceedances of PSLs for other COIs were identified in the samples. Several subsurface soil samples around the FCS contained concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene at levels above their respective PSLs. One exceedance was located near Building 11, in the general vicinity of identified petroleum contamination, albeit in shallower soil than the DRO exceedances. The other exceedances occurred in confirmation samples collected from the Building 48 excavation. Concentrations of both chemicals in the three samples were below the ADEC Method 2 cleanup levels, and no exceedances of PSLs for other COIs were identified in the samples. Exceedances of the PSLs for benzo(a)pyrene and dibenzo(a,h)anthracene occurred in three wells during several sampling events. One sample was collected from a well located within the petroleum-affected groundwater in the north-central portion of FCS (MW-62). The other two exceedances occurred in samples collected from wells in the eastern portion of FCS. The downgradient extent of both PAH-affected zones has been delineated by the existing monitoring well network.

- **Chlorinated VOCs:** Chlorinated VOC exceedances in surface soil are limited to scattered exceedances for TCE in three locations (two in the former Subarea D excavation confirmation samples, and one in a Building 1 excavation confirmation sample), as well as a single 1,2,4-trichlorobenzene exceedance north of Building 9. All detected concentrations were below their respective ADEC Method 2 cleanup levels and did not coincide with exceedances for other COIs. TCE was detected above its respective PSL in several subsurface soil samples, with some clustering of PSL exceedances in the vicinity of Building 22 and 24’s excavation. All results were below the ADEC Method 2 cleanup level, and no patterns of occurrence suggesting possible unknown or unexplored source areas were identified. However, most of the samples with exceedances were obtained from sidewalls or floors of excavations, which suggests the presence of VOCs in soil and debris removed from the excavation. Chloroform was also detected above its PSL in several isolated subsurface soil samples. As with TCE, all chloroform concentrations were below the ADEC Method 2 cleanup level, and the extent of any impacted soil has been determined. The samples with the highest concentrations (up to 100 times the PSL for TCE) were collected at MW56 and MW61 in the central portion of FCS, between Buildings 14 and 49. Wells with lower concentrations of these chemicals are located north of this area and appear to be aligned with the overall north-northwesterly groundwater flow direction. The downgradient extent of the VOC-affected groundwater was established during the 2009 northern plume investigation by soil-boring grab samples, followed by installation of MW82, MW83, and MW84. Chlorinated VOCs have not been detected above PSLs in samples collected from the deep well (MW80) installed in the apparent source area. The chlorinated VOC plume is well outside of the water supply well capture zones. The predominant VOC with exceedances in soil gas was chloroform, with exceedances occurring throughout the FCS and all exceedances being below the ADEC target level for shallow and subslab soil gas. The chloroform exceedances do not coincide with any areas of contaminated soil or groundwater at the FCS. The distribution of the chlorinated VOC exceedances in soil gas also appears to be inconsistent with the chlorinated VOC-affected soil and groundwater in the northern part of the FCS.

- **1,2,3-Trichloropropane:** No exceedances of the PSL were identified in surface soil. The one exceedance of the PSL for 1,2,3-trichloropropane for soil occurred in a confirmation sample collected at a depth of 4 feet in the excavation at Building 22 and 24. The result is greater than the ADEC Method 2 cleanup level, but the lateral extent of the contamination appears to be very limited as the sample is surrounded by other confirmation samples without exceedances. The 1,2,3-trichloropropane exceedances in groundwater are scattered around the FCS, but the higher-magnitude exceedances (greater than 10 times the PSL) are clustered in the east-central portion of FCS, north and east of the Buildings 22 and 24 excavation. Groundwater flow in this portion of the FCS is typically to the north-northwest, and the downgradient extent of the 1,2,3-trichloropropane-affected groundwater in that direction has been determined by the existing well network. The passive soil gas and groundwater investigation conducted east of the FCS in 2009 delineated the plume to the east and confirmed that the 1,2,3-trichloropropane plume does not extend into the predicted 1,000-gpm capture zone for the FWA water supply wells. The single 1,2,3-trichloropropane exceedance in soil gas at SG033-R does not coincide with the 1,2,3-trichloropropane-affected soil and groundwater in the vicinity of Buildings 22 and 24 eastern part of the site.

- **Explosives:** Explosive compounds were not detected in surface or subsurface soil at concentrations above the PSLs. RDX was detected above the PSL in groundwater samples collected from several wells located in the north-central portion of FCS. The RDX exceedances were collocated with the highest concentrations of DRO. The extent of the affected groundwater has been delineated.

- **Pesticides:** 4,4'-DDT was detected at concentrations above the PSL in soil samples collected from the Building 11, Building 19, and former Subarea D excavations. These sample locations are surrounded by locations without exceedances and concentrations are below the ADEC Method 2 cleanup level. Heptachlor and dieldrin were detected above their respective PSLs in samples collected from several wells located in the north-central portion of the FCS. The pesticide exceedances are collocated with the highest concentrations of DRO. The extent of the affected groundwater has been delineated.

- **SVOCs:** Two SVOCs (n-nitrosodi-n-propylamine and n-nitrosodimethylamine) were detected above their PSLs near Building 48 in the central portion of FCS. The n-nitrosodi-n-propylamine exceedances occurred in samples collected at depths of 12 and 16 feet bgs during the PSE II, and the n-nitrosodimethylamine exceedance occurred in a sample collected at 7 feet bgs at the bottom of an excavation at Building 48. Both chemicals are unlikely to have been used at the FCS since they are mainly chemicals produced in small amounts for research and may also be byproducts of certain manufacturing processes. Bis(2-ethylhexyl)phthalate was detected above its PSL in samples collected from several monitoring wells located in the eastern part of the FCS during the fall 2008 sampling event. Concentrations of the SVOC were all below the ADEC Method 2 cleanup level and the PSL-exceeding concentrations were not repeated during subsequent sampling events.

Migration to Groundwater Evaluation

Concentrations of target analytes in surface and subsurface soil were compared to groundwater protection screening levels to evaluate possible correlation of COI concentrations in soil with those of groundwater and to identify areas at the FCS where residual soil contamination may still be present.

In general, the lists of analytes with exceedances of the migration to groundwater screening levels do not match the list of chemicals detected above the groundwater PSLs during extensive groundwater sampling at FCS. Only 1,1,2-trichloroethane, 1,2,3-trichloropropane, benzene, DRO, RRO, GRO, TCE, PCE, vinyl chloride, and gamma BHC (lindane) are shared among the lists, and the distribution of groundwater impacts predicted by the migration to groundwater screening level exceedances in soil is far more extensive than has been measured in groundwater at the FCS. The analytes found in groundwater are consistent with those detected in waste and soil samples collected from the apparent source areas (i.e., zones of buried debris and petroleum release sites); however, outside of these source areas, there is little correlation between the locations of the groundwater plumes and exceedances of the migration to groundwater levels. Nonetheless, soil in the areas encompassed by the exceedances would be considered contaminated and, if excavated, would not be usable for fill in areas where surface water is present.

Summary of Residual Contamination

Residual soil contamination at the FCS is limited to four localized subsurface soil hot spots (samples where the concentration of a COI exceeds the actual ADEC Method 2 cleanup level) beneath and around portions of the FCS where contaminated soil and debris were removed during pre-RI or RI field activities. These subsurface hot spots consist of two DRO exceedances in the vicinity of Buildings 7 and 8 at depths of 12 and 16 feet; one 1,2,3-trichloropropane exceedance at a depth of 4 feet between Buildings 22 and 24; and a PCB exceedance at a depth of 12 feet near Building 52. No hot spots were identified in surface soil.

The occurrence of contaminated groundwater is consistent with the locations and types of contaminant sources found and removed at the FCS. Elevated concentrations of petroleum hydrocarbons, chlorinated solvents and their breakdown products, 1,2,3-trichloropropane, and several other analytes were detected in groundwater at the FCS. The lateral and vertical extents of the affected groundwater have been determined for all COIs, and groundwater impacts are limited to localized regions of the FCS and do not extend into the 1,000-gpm capture zone for the FWA water supply wells.

Fate and Transport Considerations for Residual Contamination

Localized areas of buried debris, contaminated soil, and contaminated groundwater remain at the FCS, but are unlikely to act as ongoing sources of contamination or to migrate to other areas or media where human or ecological receptors may be exposed for the following reasons:

- **Potential for future releases from inaccessible debris beneath buildings:** Buried debris appears to extend beneath five buildings at the FCS and cannot be easily removed without compromising the structural integrity of the building foundations. The possibility that this residual debris might release volatile chemicals that could pose a potential for exposure to future building residents through the indoor air pathway is considered remote, given that 13 excavations targeting large and dense geophysical anomalies have been conducted at the FCS with the following relevant observations:

  – Of the 1,058 drums found in RI excavations, including the excavation and removal of drums beneath Building 49, the majority of the drums were empty and only 8 drums (less than 0.5 percent) contained sufficient liquid contents to allow for sampling and analysis. The remainder of the drums with contents contained tar, asphalt, and other non-hazardous solid and semi-solid materials.

  – Liquids in the eight drums were characterized primarily as fuel and water mixtures, with few VOCs. None of the drums contained chlorinated solvents, which tend to be more of concern in terms of volatility, migration, and toxicity. (Note: The findings from the PSEII drum investigation were very similar to those of the RI. Two drums were removed with contents: one drum contained liquid with petroleum hydrocarbons; the other contained sludge with petroleum hydrocarbons, pesticides, and metals.)

  The types of materials found in the subsurface to date at the FCS suggest that it is unlikely that inaccessible debris beneath the buildings contains intact drums containing volatile liquids. Even if such a drum were present, however, any liquid contained therein would likely be petroleum-based. Given the low likelihood of an intact drum, and because petroleum compounds tend to have higher degradation rates and lower toxicity than do halogenated solvents, the likelihood of such a future release contributing to indoor air exposure is low.

- **Petroleum in groundwater:** Groundwater in the vicinity of Buildings 7 through 9 and at MW77 is contaminated by DRO, naphthalene, and other PAHs. However, no evidence of a floating liquid-phase hydrocarbon layer has been observed in monitoring wells at the FCS and most petroleum-contaminated soil encountered during construction and investigation activities has been removed from the FCS; therefore, the area of affected groundwater is unlikely to expand. On the basis of the apparent age of the release and the absence of the more volatile components (such as benzene) downgradient of the apparent source, it appears that the source has been depleted of its more mobile and soluble components. In addition, because weathered diesel fuel contains relatively few volatile compounds, there is little possibility of impacts to indoor air.

- **Chlorinated solvents in groundwater:** Chlorinated solvents such as TCE and PCE were detected in soil, groundwater, and soil gas at the FCS. Breakdown products of chlorinated solvents, most notably vinyl chloride, were also detected in groundwater, potentially indicating a naturally occurring attenuation process in progress at the FCS. Concentration gradients indicate that TCE- and PCE-contaminated groundwater appears to originate just north of Building 48 and extend northward to the FCS boundary. The relatively low concentrations of TCE and PCE are not suggestive of an extensive release, and neither chemical was detected above its PSL in a deep well located in the apparent source area. Therefore, ongoing releases from a DNAPL layer of solvent within the aquifer are not suspected and the area of impact is unlikely to expand. In addition, vinyl chloride and cis-1,2-dichloroethene are present within and downgradient of the source area, which suggests that conditions in groundwater at the FCS are conducive to anaerobic biodegradation.
- **1,2,3-Trichloropropane in groundwater:** A zone of 1,2,3-trichloropropane-affected groundwater was identified in the eastern portion of the FCS. The chemical was presumably used as a cleaning and degreasing agent at some time in the history of operations at the FCS. The chemical breaks down slowly in groundwater. The affected wells are located along the 1,700-gpm capture zone for the FWA water supply and, based on passive soil gas sample data and groundwater data for wells installed between the 1,2,3-trichloropropane plume and the water supply wells, there is no indication of plume movement toward the water supply wells. In addition, groundwater dilution calculations suggest that even if monitoring wells MW-08, MW-47, and MW-39 (the wells along the fringe of the capture zone for the 1,700-gpm pumping rate) were within the typical pumping rate capture zone (the average pumping rate over the past 5 years is 1,327 gpm), the concentrations of 1,2,3-trichloropropane in groundwater would be diluted by a factor of more than 100 by the time it reached the supply well.

Explosive Hazard Assessment

During the RI, the Army evaluated the potential risk of encountering munitions and explosives of concern (MEC). The evaluation, conducted following the process approved by the Department of Defense Explosives Safety Board (DDESB), was designed to determine whether MEC was comingled with the large amounts of metal debris and other trash. The munitions evaluation had three principal purposes: (1) protect the workers on the site, (2) ensure the general public’s safety during the evaluation, and (3) identify the additional response actions (removal, remedial action, institutional controls, or combinations of these) that may be required to ensure safe residential use. As part of the evaluation, the Army investigated large anomalies identified during the Cold Regions Research and Engineering Laboratory (CRREL) geophysical surveys conducted in 2006 and 2007. The MD and RRD discovered were comingled with large quantities of metal debris and other trash and were very minor components of materials that were managed and disposed of in the FCS area during historical operations. The team did encounter a number of items that had been originally classified as DMM. These items (M106 8-inch projectile, M41 bomb, and M47 bomb) were not fuzed, armed, or fired. Trained explosive ordnance disposal (EOD) personnel confirmed the tentative identification and that these items were safe for transport, temporary storage, and disposal by donor charges. Excessive donor charges were used for destruction of items found in 2006 and 2007 so the explosive status of the items was unable to be determined. In 2008, the Army EOD personnel used small donor charges on those items of greatest concern (M106, M41, and M47). These items were determined to be MD after the detonation broke open each item and explosives were not found. These items were reclassified from DMM to MD because they were inert and presented no hazard. Two items were determined to be DMM—both were live 3.5-inch rocket motors on training rockets (M29) that had no warheads.

The drum and debris investigations conducted during the RI essentially eliminated any residual explosives-related risk that might have been present by removing buried scrap metal and debris (in which some munitions-related items were intermixed) anomalies and confirming removal through geophysical surveys along the bottoms of the excavations. Munitions-related items were only found intermixed with other debris; the FCS was never used as a range. It is unlikely that any explosive ordnance is present at the site and, furthermore, the probability of encounter by residents with any buried munitions that might be present is unlikely. This is because residual debris that might contain the hypothetical munitions is inaccessible in that it is located primarily beneath or close to the foundations of a few housing units. In addition, Army Garrison policies already existing at the site are designed to prevent unsupervised encounter with any hazards that may be present such as buried utilities, contaminated soil or groundwater, or residual munitions-related items.

Based on evidence collected during this extensive investigative effort, the Army determined that, regarding the issue of explosives safety, the Taku Gardens family housing development is safe for residential use.

Human Health Risk Assessment

The HHRA was conducted in accordance with EPA and ADEC risk assessment guidance. Risks were estimated for the most plausible pathways of human exposure, based on reasonably anticipated land and water uses at the FCS. The exposure scenarios evaluated included reasonably anticipated future residential, recreational/site visitor, maintenance worker, and excavation worker receptor groups. In addition, a hypothetical unrestricted exposure scenario is evaluated assuming no action and includes default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media.

For the future recreational/site visitor, maintenance worker, and future excavation worker exposure scenarios, a conservative screening approach was used to select exposure concentrations, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results observed with use of this screening approach, areal averaging of data was not considered necessary. The HHRA results for these three exposure scenarios indicate that the hazard indices (HIs) for noncarcinogenic chemicals in soil are below the EPA and ADEC threshold value of 1. The excess lifetime cancer risk (ELCR) estimates are within or below the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. Therefore, no unacceptable risk is identified for these scenarios.

Residents living at the FCS under reasonably anticipated future land use conditions were evaluated for potential exposure to chemicals detected in the following three exposure media:

- Surface soil (0 to 2 feet bgs)
- Soil gas potentially migrating to indoor air
- FWA supply groundwater currently used for domestic purposes

The multimedia HI for combined exposure by direct contact with surface soil, inhalation of indoor air originating from subslab soil gas, and domestic use of FWA supply well groundwater is below the EPA and ADEC threshold value of 1. The multimedia ELCR for combined exposure to these media does not exceed the EPA target risk range of 1×10^{-6} to 1×10^{-4} or the ADEC risk threshold of 1×10^{-5}. The results of the future residential scenario indicate that even if cumulative exposure occurs to the highest levels at any surface soil and subslab soil gas locations and is combined with exposure from domestic use of FWA supply water, HI and ELCR estimates do not exceed the EPA and ADEC risk threshold values. Therefore, no unacceptable risk is identified for the residential exposure scenario under reasonably anticipated future land use conditions. Moreover, any future exposures to soil will be further minimized by the clean soil cover that will be placed during completion of construction at the FCS and the Army Garrison policies that are already in place to preclude digging at Fort Wainwright.

For groundwater wells located within the hypothetical upper-range pumping rate (1,700-gpm) capture zone (but outside the capture zone for more typical pumping rates), the ELCR from all carcinogenic chemicals in groundwater samples exceeds the EPA target risk range of 1×10^{-6} to 1×10^{-4}, and the ADEC risk threshold of 1×10^{-5} in wells MW08, MW47, and MW79 (the ELCR at MW39 exceeds the ADEC risk threshold only). This ELCR is primarily a result of the presence of 1,2,3-trichloropropane (less than 2 μg/L) in these wells.

The results of the hypothetical unrestricted exposure scenario indicate that, under the default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, HI and ELCR estimates are above the EPA and ADEC target risk thresholds. These risk estimates are provided for comparative purposes to document the difference between unrestricted access versus the potential risk when considering existing restrictions that preclude digging onsite, and prevent use of groundwater beneath the FCS.

An important component of the HHRA was the vapor intrusion evaluation to address potential indoor exposures to future residents. The approach for evaluating vapor intrusion of volatile compounds into indoor air at the FCS is consistent with the tiered process recommended in EPA Vapor Intrusion Guidance, and included an evaluation of multiple lines of evidence. Based on the available monitoring data generated during the RI, all lines of evidence corroborate to support the conclusion that the vapor intrusion pathway does not represent unacceptable risk at the FCS.

Ecological Risk Assessment

The ERA was conducted in accordance with ADEC and EPA guidance, focusing on COPECs, receptors, and areas where the greatest potential for ecological exposure might be expected. The risk to offsite terrestrial wildlife and offsite aquatic resources potentially exposed to the COPECs occurring in the drainage swale and groundwater is considered to be low. This conclusion was drawn in consideration of (1) likely infrequent use of small drainage swales, (2) their ephemeral nature, (3) the relatively low magnitudes by which COPEC concentrations exceed screening levels, and (4) the expected amount of spatial attenuation, indicating that unacceptable risk to ecological populations is unlikely. Given these findings, no COPECS or areas were identified that would require additional sampling and evaluation from the drainage swale or perimeter well points to protect ecological resources potentially using the FCS.

Conclusions

The overall goals of the RI have been accomplished: sufficient data have been collected from all media of interest in the FCS to characterize the nature and extent of contamination, evaluate potential hazards from munitions-related items, and assess potential risks to human and ecological receptors. Conclusions of the RI are as follows:

- **Nature and Extent of Contamination:** The nature and extent of contamination in FCS environmental media have been determined. No further assessment of site conditions is required.

- **Explosives Hazards:** The weight of evidence provided by the geophysical and intrusive investigations indicate that there is no reason to suspect that main-charge, high explosives, or explosively configured munitions were managed or disposed of in this area during historical operations. With the exception of the rocket motor propellant, no other explosives were confirmed on the FCS. The Army concludes that, regarding the issue of explosives safety, the Taku Gardens housing area is safe for residential use. It is unlikely that any explosive ordnance is present at the FCS, and furthermore, the probability of encounter by residents with any buried munitions that might be present is itself quite remote.

- **Human Health Risk Assessment:** The site-specific risk estimates for all current and reasonably anticipated future exposure scenarios at the FCS, including future residential uses, are below the EPA and ADEC risk threshold values. Therefore, no unacceptable risk is identified. In order to address any remaining uncertainty related to debris remaining beneath some buildings, soil gas will be retained as a medium of concern in the FS and considered for the evaluation of remedial alternatives.

- **Ecological Risk Assessment:** No unacceptable risk was identified for terrestrial wildlife and offsite aquatic resources potentially exposed to the COPECs occurring in the drainage swale and groundwater at the FCS.

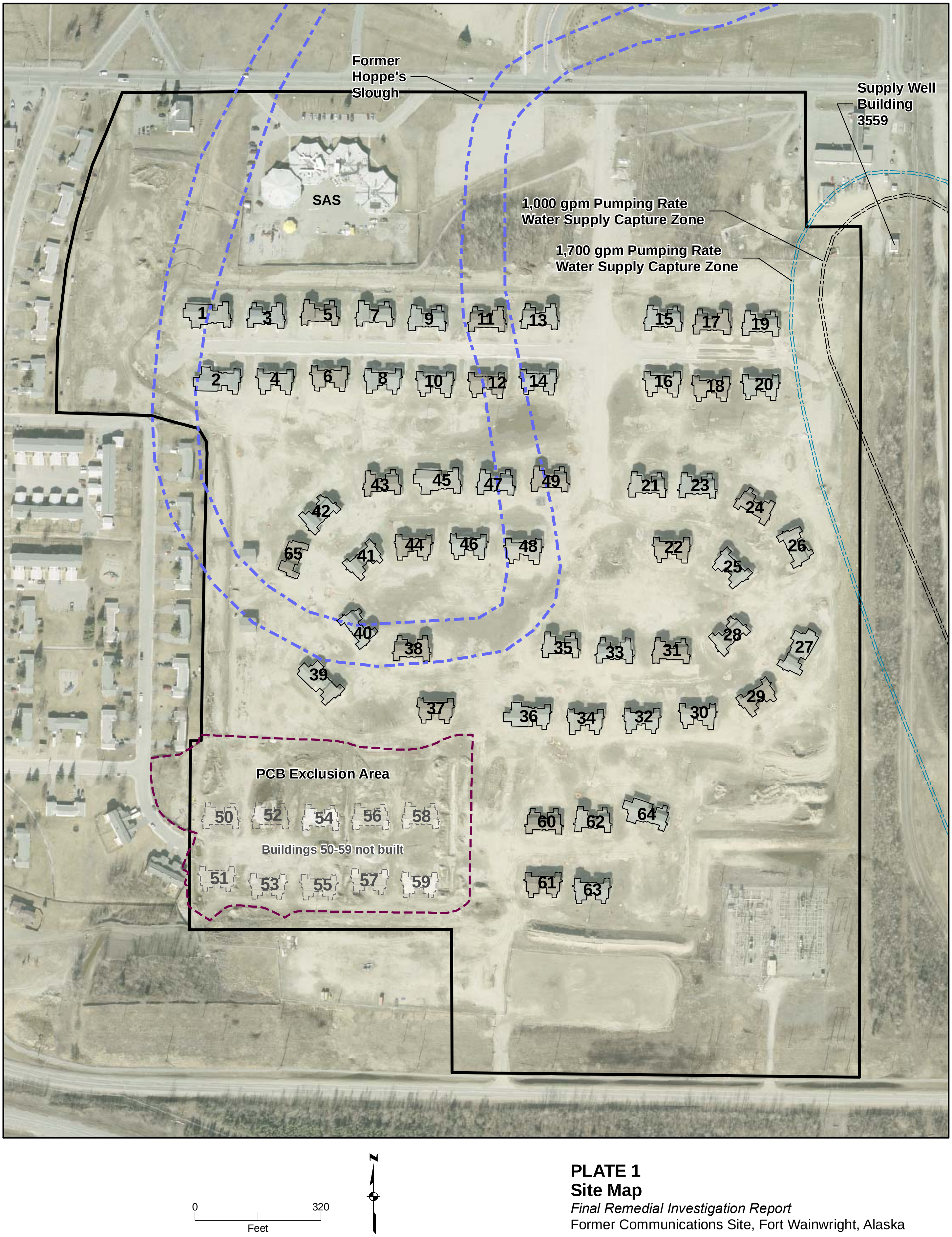


PLATE 1
Site Map
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\SIMBA\PROJ\USARMYCORPSOFENGINEE\357465TAKUGARDENS\GIS\MAPFILES\RI_2009\PLATE1_SITEMAP.MXD DMORIN1 4/24/2009

CH2MHILL

Contents

Appendixes

Tables

Plates

Figures

Abbreviations and Acronyms

°F	degrees Fahrenheit
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
µm/m³	micrograms per cubic meter
AAC	Alaska Administrative Code
ACM	asbestos-containing material
ADAF	age-dependent adjustment factor
ADEC	Alaska Department of Environmental Conservation
AK	Alaska
AKNHP	Alaska Natural Heritage Program
Army	U.S. Army
atm-m³/mole	atmospheres-meters cubed per mole
ATSDR	Agency for Toxic Substances and Disease Registry
BCF	bioconcentration factor
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CalEPA	California Environmental Protection Agency
CDFA	1-chloro-1,1-difluoroethane
CEM	conceptual exposure model
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
cm²	square centimeters
COI	chemicals of interest
COPC	chemical of potential concern
COPEC	chemicals of potential ecological concern
CRREL	Cold Regions Research and Engineering Laboratory
CSM	conceptual site model
DBPC	1,2-dibromo-3-chloropropane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DEW	Distant Early Warning
DFA	1,1-difluoroethane
DL	detection limit
DMM	discarded military munitions
DNAPL	dense non-aqueous phase liquid
DOD	U.S. Department of Defense
DPW	Directorate of Public Works
DRMO	Defense Reutilization and Marketing Office
DRO	diesel-range organics
EcoSSL	ecological soil screening levels
ELCR	excess lifetime cancer risk

EM	electromagnetic
EOD	explosive ordnance disposal
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ERBSC	ecological risk-based screening concentration
EZ	exclusion zone
FCS	Former Communication Site
FFA	Federal Facilities Agreement
FNSB	Fairbanks North Star Borough
ft^2	square foot
ft^3	cubic feet
FWA	Fort Wainwright, Alaska
GI	gastrointestinal
gpm	gallons per minute
GPR	ground-penetrating radar
GRO	gasoline-range organics
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
HTH	calcium hypochlorite
IDW	investigation-derived waste
IED	improvised explosive device
IEUBK	Integrated Exposure Uptake Biokinetic
INRMP	Integrated Natural Resources Management Plan
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
Jacobs	Jacobs Engineering Group, Inc.
kg	kilograms
Kp	permeability coefficient(s)
LAAF	LADD Army Airfield
LAFB	LADD Air Force Base
LOAEL	lowest observed adverse effect level
m^3/day	cubic meters per day
MAG	magnetometer
MARB	material assessment review board
MC	munitions constituents
MD	munitions debris
MDL	method detection limit
MEC	munitions and explosives of concern
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
MI	multi-incremental
mm	millimeter

MOA	mode of action
mph	mile(s) per hour
mV	millivolt
ND	nondetect
NFA	no further action
NOAA	National Oceanic and Atmospheric Administration
NNSM	n-nitrosodimethylamine
NNSPR	n-nitrosodi-n-propylamine
NOAEL	no observed adverse effect level
NPL	National Priorities List
Oasis	Oasis Environmental, Inc.
ORNL	Oak Ridge National Laboratory
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PEC	probable effect concentration
PEL	probable effect level
PID	photoionization detector
PINS	portable isotopic neutron spectroscopy
POL	petroleum, oil, and lubricants
ppm	parts per million
PPRTV	provisional peer-reviewed toxicity values
PRSE Report	*Draft Preliminary Risk Screening Evaluation Report, Taku Gardens Former Communications Site, Fort Wainwright, Alaska*
PSE	Preliminary Source Evaluation
PSL	project screening level
PX	post exchange
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RfC	reference concentration
RfD	reference dose value
RI	remedial investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RRO	residual-range organics
RSL	regional screening level
RSP	Render Safe Procedures
SARA	Superfund Amendments and Reauthorization Act of 1986
SAS	School Age Services
SIM	selective ion monitoring
SOP	standard operating procedure
SVOC	semivolatile organic compound
TCE	trichloroethylene
TCRA	Time Critical Removal Action
TEC	threshold effect concentration
TEL	threshold effect level

TEU	technical escort unit
TIC	tentatively indentified compound
TNT	trinitrotoluene
TSA	Transformer Service Area
TSCA	Toxic Substances Control Act
UCL	upper confidence level
USACE	U.S. Army Corps of Engineers
USAED	U.S. Army Engineering District
USAF	U.S. Air Force
USC	United States Code
UST	underground storage tank
UXO	unexploded ordnance
VF	volatilization factor
VOC	volatile organic compound
WQC	water quality criteria
yd^3	cubic yard

SECTION 1

Introduction

This report presents the findings of the remedial investigation (RI) conducted at the Former Communications Site (FCS), also known as Taku Gardens family housing development, on Fort Wainwright, Alaska (FWA). This RI report was prepared by CH2M HILL, under contract to the Alaska District of the U.S. Army Corps of Engineers (USACE) as Task Order 13 of Contract No. W911KB-05-D-0010, for the U.S. Army Garrison, Fort Wainwright, Alaska.

The information provided in this report demonstrates that the U.S. Army Garrison has conducted an extensive environmental investigation at the FCS and, as a result of this investigation, now understands the nature and extent of contamination remaining at the site, the potential for human and ecological receptors to be exposed to this contamination, and the current and future risks associated with such exposure. The results indicate that, based on the available data and using health-conservative exposure assumptions, no unacceptable risk is identified under reasonably anticipated future land and water use conditions at the FCS.

Fort Wainwright is within the Fairbanks North Star Borough (FNSB) in central Alaska and covers approximately 918,000 acres on the east side of the City of Fairbanks. Fort Wainwright is a federally owned facility managed by U.S. Army Garrison, Fort Wainwright, an installation-level command overseen by its higher headquarters, the U.S. Army Installation Management Command-Pacific. The FCS is located in the west-central portion of Fort Wainwright (Figure 1-1) and has a history of mixed uses, including salvage/reclamation yard activities, debris disposal, garden plots, barracks and company headquarters, communication and radar systems, possible ammunition storage, and possible firefighter training.[1] Currently, the FCS encompasses the nearly completed Taku Gardens family housing development covering approximately 54 acres (Figure 1-2). Environmental contamination and buried debris containing munitions-related items were discovered during the course of housing construction. The 110 housing units (55 buildings) have been constructed but will not be released for occupancy until the ongoing site investigation and any remedial activities have been completed, and until the Army, USACE, the Alaska Department of Environmental Conservation (ADEC), and the U.S. Environmental Protection Agency (EPA) agree that the area is safe for residential occupation.

[1] A limited number of written records describing activities specifically occurring at the FCS during the course of its use are available. Much of what is known about the FCS has been inferred from examining and comparing historical photographs (dating from 1947 to the present), the 1958 Fort Wainwright "Master Plans," past geographical surveys, and military operations concurrent with similar missions conducted at other locations.

1.1 Remedial Investigation Purpose

Soil, groundwater, and possibly other environmental media have been contaminated as a result of historical uses and past disposal practices at the FCS. The purpose of the RI is to collect sufficient data of appropriate quality to accomplish the following:

- Assess the nature and extent of soil and groundwater contamination at the FCS
- Determine whether other environmental media have been affected by contamination
- Conduct risk assessments to quantify potential risks posed by exposure of expected Taku Gardens residents, current and future recreational users and maintenance workers, and possible ecological receptors to contaminants at the FCS and to evaluate the no action scenario
- Support informed risk management decisions

1.2 Site Description

Taku Gardens at the FCS includes 110 new housing units (in 55 buildings). The buildings are intended for use as family housing for Fort Wainwright military personnel and their families, but are currently unoccupied. An additional 20 housing units (10 buildings) were planned for the development, but construction was stopped in the early stages and these buildings are not finished. Although the recent transfer of the 172nd Stryker Brigade to Fort Wainwright has created a pressing need to use this new housing, potential risk to human health and the environment from prior FCS activities must be addressed first.

Taku Gardens is located between Alder and Neely roads, east of White Street and west of the Fort Wainwright Power Plant. Figure 1-2 shows the layout of the Taku Gardens family housing development. The area was selected for military family housing in 2002 and 2003. Preconstruction geotechnical samples were collected in late 2003 and again in 2004. Geophysical testing was also completed during this time and indicated several buried debris areas. Work began on the Taku Gardens family housing development in mid-2005 with the installation of foundations and underground utilities necessary for the construction of the 65 residential buildings and 2 mechanical buildings.

During construction in July 2005, equipment operators uncovered soil contaminated with polychlorinated biphenyls (PCBs) and petroleum. They also unearthed an extensive array of buried debris, including crushed drums, scrapped equipment, and munitions-related items used for troop support and training in the 1940s and 1950s.

The majority of the 110 housing units in the 55 completed buildings have been completely finished, with the exception of the installation of major appliances. The contractor has winterized the units by activating the electrical systems, steam mains, and glycol heat exchangers. The 20 additional housing units in the southwestern portion of the FCS (Buildings 50 through 59)[2] will not be completed and their partially installed foundations were removed in 2009.

---

[2] The building numbers used in this report are those used in construction planning and are not the same as the physical addresses of the now-constructed buildings.

Preliminary site investigations initially divided the FCS into five subareas (Subareas A through E) based on the historical usage, review of historical aerial photographs and maps, and the types of contamination and debris encountered. The subareas are shown in Figure 1-2 and described below:

- **Subarea A** consisted of the northeast quadrant of the housing development, where buried debris containing munitions-related items was identified.
- **Subarea B** was located along the northern boundary of the development, where company headquarters and barracks buildings were constructed over a filled former oxbow of the Chena River named Hoppe's Slough, and where petroleum contamination was identified during preliminary investigations.
- **Subarea C** was located along the northeastern corner of the development, where company headquarters and barracks buildings were constructed over Hoppe's Slough.
- **Subarea D** consisted of the southeast corner of the development that was part of a salvage yard in the 1940s, was potentially used for ammunition storage in the 1950s, and where the Golden Valley Electric Association station was constructed in the late 1970s.
- **Subarea E** was the southwest corner of the development and consisted of land that housed communications operations in the 1950s, but was cleared and used for personal gardens through the late 1990s. During initial construction activities, soil in the area was found to be contaminated with PCBs and other types of contaminants. The partially installed foundations and partially installed utilities for the additional 20 housing units in 10 buildings (Buildings 50 through 59) in this area were not completed and the foundations were removed in 2009.

With the exception of PCB contamination in Subarea E and the presence of munitions-related items intermixed with debris in Subarea A, further investigation and data evaluations conducted in support of this RI have determined that the initial subareas do not constitute distinct sources or zones of contamination and are only useful as general geographic references.

1.3 Fort Wainwright History

Fort Wainwright has been used continuously by the U.S. Department of Defense (DOD) for military operations since 1938. Originally known as LADD Army Airfield (LAAF), the post was established for cold weather experimentation. During World War II, LAAF served as a transfer point in the Lend-Lease program. Between 1942 and 1945, almost 8,000 combat and transport aircraft were transferred to Soviet aircrews at LAAF. In 1947, the newly formed U.S. Air Force (USAF) assumed control of LAAF, which was redesignated LADD Air Force Base (LAFB). LAFB served as a resupply and maintenance base for the Remote Distant Early Warning (DEW) sites and experimental ice stations in the Arctic Ocean. During the Korean conflict, LAFB served as part of the defense network, and was the site of the first Nike Hercules Missile launch from a tactical missile site in December 1959.

On January 1, 1961, the Army resumed control over LAFB. The Army renamed the installation Fort Wainwright, after General Jonathan M. Wainwright, the commander of the forces defending the Bataan Peninsula in the Philippines at the beginning of World War II.

Fort Wainwright has been home to several units, including the 171st Infantry Brigade (Mechanized), a Nike-Hercules Battalion, the 172nd Infantry Brigade, and the 6th Infantry Division (Light). In July 2001, the Army announced its intent to make the 172nd Infantry Brigade, located at Forts Wainwright and Richardson, into one of the next four interim brigade combat teams as part of its transformation to a more strategic and responsive force.

During decades of military use at Fort Wainwright, routine operations and storage practices resulted in accidental releases of chemicals to the ground and underlying groundwater or nearby surface water. Former waste disposal practices were also responsible for releases to the environment. Beginning in the late 1950s, most nonhazardous waste was disposed of in the sanitary landfill located in the north-central portion of Fort Wainwright. Naturally occurring surface depressions (such as former slough channels) were used for disposal of waste construction material and were covered with fill. Other waste disposal practices at Fort Wainwright included using waste oils for dust control on unpaved roads and for firefighting drills; spreading ash on icy roads; burning waste oil and liquid waste for energy recovery in the power plant; and discharging or dispersing used oils, solvents, or fuel spills into floor drains in buildings across the installation (Agency for Toxic Substances and Disease Registry [ATSDR], 2003). Fort Wainwright generated hazardous waste materials in the past, including pesticides; PCBs; petroleum, oil, and lubricants (POL); and battery fluids. Such chemicals were largely associated with spent solvents and ignitable wastes from aircraft and vehicle maintenance shops, contaminated motor vehicle and aviation fuels, painting waste, coal fly ash, and spent non-recyclable vehicle batteries. Fort Wainwright also received small quantities of radioactive tritium waste and low-level radioactive materials (such as radium dials) (ATSDR, 2003).

1.4 Regulatory History

In August 1990, Fort Wainwright was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) National Priorities List (NPL). Current environmental assessment and remediation activities at Fort Wainwright comply with CERCLA requirements, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). Activities also comply with a March 1992 Federal Facilities Agreement (FFA) among USEPA, DOD, and ADEC. The FFA identifies the authorities and responsibilities of the parties and integrates CERCLA requirements with other relevant federal and state remedial programs, such as the Resource Conservation and Recovery Act (RCRA).

The general purposes of the FFA, as defined in Section III of the agreement, are to ensure the following:

- Environmental impacts associated with past and present activities at Fort Wainwright are thoroughly investigated, and appropriate removal and/or remedial action(s) is taken, as necessary, to protect the public health, welfare, and the environment.
- A procedural framework and schedule are established for developing, implementing, and monitoring appropriate response actions at Fort Wainwright in accordance with CERCLA, the National Contingency Plan, national Superfund guidance and policy, RCRA, national RCRA guidance and policy, and applicable state law.

- Cooperation, exchange of information, and participation of the parties in such actions are facilitated.

Also in 1992, the Army and the State of Alaska signed a two-party agreement specifically addressing petroleum contamination. According to the ATSDR (2003), the petroleum contamination is generally associated with leaking underground storage tanks (USTs) or surface spills of petroleum products. This agreement is included in the 1992 FFA as an attachment.

The FFA was amended in 2007 to incorporate the FCS; this was done by creating a new operable unit (OU), OU 6, for the site and providing the remedial project managers (RPMs) with the authority to create additional OUs should new source areas be discovered. A copy of the amendment is provided in Appendix A.

1.5 Military Munitions-Related Terms and Definitions

This report uses DOD-specified terms to describe military munitions-related activities, personnel, and munitions-related items[3] found at the FCS:

- **Discarded Military Munitions (DMM):** Military munitions that have been abandoned without proper disposal or removed from storage from a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance (UXO), military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of, consistent with applicable environmental laws and regulations (United States Code [USC], Title 10, Section 2710[e][2]).
- **Disposal:** End-of-life tasks or actions for residual materials resulting from demilitarization or disposition operations.
- **Explosive Ordnance Disposal (EOD):** The detection, identification, onsite evaluation, act of rendering safe, recovery, and final disposal of UXO and other munitions that have become an imposing danger; for example, by damage or deterioration.
- **Explosive Ordnance Disposal Personnel:** Military personnel who have graduated from the Naval EOD School, are assigned to a military unit with an Armed Service-defined EOD mission, and meet Armed Service and assigned unit requirements to perform EOD duties. EOD personnel have received specialized training to address explosive and certain combat arms hazards during both peacetime and wartime. EOD personnel are trained and equipped to perform Render Safe Procedures (RSP) on nuclear, chemical, and conventional munitions and on improvised explosive devices (IED).
- **Military Munitions:** Military munitions means all ammunition products and components produced for or used by the arms forces for national defense and security. The term includes confined gaseous, liquid, and solid propellants; explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents; chemical munitions, rockets, guided and

[3] "Munitions-related items" is used in this report as a general term to describe munitions debris, range-related debris, and discarded military munitions found at the FCS and later classified according to the DOD-specified terms.

ballistic missiles, bombs, warheads, mortar rounds, artillery ammunition, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges; and devices and components thereof.

- **Munitions and Explosives of Concern (MEC):** This term distinguishes specific categories of military munitions that, present in high-enough concentrations, can pose unique explosives safety risks: (1) UXO, as defined in 10 USC 101(e)(5); (2) DMM, as defined in 10 USC 2710(e)(2); or (3) munitions constituents (MC) (such as trinitrotoluene [TNT] and hexahydro-1,3,5-trinitro-1,3,5-triazine [RDX]), as defined in 10 USC 2710(e)(3).
- **Munitions Debris:** Remnants of munitions (for example, fragments, penetrators, projectiles, shell casings, links, and fins) remaining after munitions use, demilitarization, or disposal.
- **Range-Related Debris:** Debris, other than munitions debris, collected from operational ranges or from former ranges (includes target debris, military munitions packaging, and crating material).
- **Technical Escort Unit (TEU):** A DOD organization staffed with specially trained personnel that provide verification, sampling, detection, mitigation, render safe actions, decontamination, packaging, escort, and remediation of chemical, biological, and industrial devices or hazardous material.
- **UXO:** Military munitions that (1A) have been primed, fuzed, armed, or otherwise prepared for action; (2) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (3) remain unexploded whether by malfunction, design, or any other cause (10 USC 101(e)(5)(A) through (C)).
- **UXO-Qualified Personnel:** Personnel who have performed successfully in military EOD position, or are qualified to perform in specific Department of Labor, Service Contract Act, Directory of Occupations, or UXO contractor positions.

1.6 Sources of Information Used in This Report

Information and analytical data provided in the following documents, as well as data gathered in 2007, 2008, 2009, and 2010 (see Section 2.3), were used to develop this report:

- *2007 Field Data Report, Taku Gardens Former Communications Site, Fort Wainwright, Alaska* (2007 Field Data Report; CH2M HILL, 2008a)
- *Draft Preliminary Risk Screening Evaluation Report, Taku Gardens Former Communications Site, Fort Wainwright, Alaska* (PRSE Report; CH2M HILL, 2008b)
- *Interim Draft Remedial Investigation Management Plan* (CH2M HILL, 2008c)
- *Revised Interim Draft Remedial Investigation Work Plan, FWA 102 Former Communications Site, Fort Wainwright, Alaska* (RI Work Plan; CH2M HILL 2008d)

- *Addendum 1 to the Remedial Investigation Work Plan, Sound Berm Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Revision 1* (CH2M HILL, 2007a)
- *Addendum 2 to the Remedial Investigation Work Plan, Soil Pile Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final* (CH2M HILL, 2007b)
- *Addendum 3 to the Remedial Investigation Work Plan, Soil Gas Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final* (CH2M HILL, 2007c)
- *Addendum 4 to the Remedial Investigation Work Plan, Groundwater Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final* (CH2M HILL, 2007d)
- *Former Communications Site PCB Removal Action, Final* (Jacobs, 2007a)
- *Munitions and Explosives of Concern Support Work Plan* (Jacobs, 2007b)
- *2007/2008/2009 Former Communications Site Drum and Debris and PCB Investigation Report* (Jacobs, 2010)
- *Preliminary Source Evaluation II Report Taku Gardens, Fort Wainwright, Alaska* (Final) (North Wind, Inc., 2007)
- *Preliminary Source Evaluation 1 Narrative Report, Former Communications Site, Fort Wainwright, Alaska, Interim Final* (Oasis, 2007)
- Notes from meetings held with the USEPA and ADEC

A full list of references is included in Section 9.

1.7 Report Organization

In addition to this introductory section, this report consists of the following sections:

- **Section 2, Site Description—**describes the physical characteristics, operational history, and investigation history of the FCS.
- **Section 3, Remedial Investigation Approach—**describes the approaches toward completing the RI, including conceptual site model (CSM) development, and approaches for characterizing possible sources, evaluating data usability, determining the nature and extent of contamination, identifying possible explosive hazards, and assessing risks to human and ecological receptors.
- **Section 4, Source Characterization—**identifies the potential sources of contamination in the FCS.
- **Section 5, Nature and Extent of Contamination—**describes the results of the nature and extent of contamination evaluations for chemicals of interest (COI)[4] remaining in soil and groundwater at the FCS, summarizes the findings of the cross-media impact evaluations, and presents the updated CSM based on these findings.

[4] COIs are those chemicals with one or more exceedances of the project screening levels, which are conservative, risk-based values used to evaluate the nature and extent of contamination at the FSC.

- **Section 6, Military Munitions Investigation Activities and Hazard Assessment—** summarizes the results of the explosive hazard analysis conducted by the Army to account for potential risks to future residents from undiscovered munitions-related items.
- **Section 7, Human Health and Ecological Risk Assessments—**identifies chemicals of potential concern (COPC)[5] and describes the findings of the human health and ecological risk assessments for the FCS.
- **Section 8, Conclusions—**summarizes results and identifies areas where no further action is required, and where COPCs in site media pose unacceptable risk.
- **Section 9, References—**lists sources used to prepare this report.

Tables and figures are provided at the end of the section in which they are first mentioned. Plate 1, a site map that can be viewed alongside the report text for the reader's convenience, is included at the front of the main report body.

Other supporting documentation is provided in the appendixes:

- Appendix A—2007 Amendment to the Federal Facilities Agreement
- Appendix B—Capture Zone Modeling Information and Water Supply Production Data Sheets
- Appendix C—Historical Aerial Photographs and Maps
- Appendix D—2007/2008/2009 Former Communications Site Drum and Debris and PCB Investigation Report.
- Appendix E—RI Field Data and Sampling Records
- Appendix F—RI Data Quality Evaluation Reports and Third-Party Data Review Report
- Appendix G—Analytical Data Processing Information
- Appendix H—Data Usability Evaluation Results
- Appendix I—Analytical Results for Samples Collected at the FCS
- Appendix J—EOD Response Reports
- Appendix K—Soil Arsenic Background Evaluation
- Appendix L—Explosives Safety Submission
- Appendix M—Risk Assessment Calculations and Ecoscoping Form
- Appendix N—Overview of Vapor Intrusion Pathway Evaluation
- Appendix O—Responses to Comments received from the EPA and ADEC on the *Draft Remedial Investigation Report FWA 102 Former Communications Site Fort Wainwright, Alaska*

[5] COPCs are those chemicals that are carried through the risk quantification process, and take into consideration identification of detected chemicals, background concentrations, essential nutrients, and availability of toxicity factors.

- Appendix P—2010 DDT Investigation Information
- Appendix Q—January 2010 Subslab Soil Gas and Ambient Air Sample Information
- Appendix R—July 2010 Subslab Soil Gas and Ambient Air Sample Information
- Appendix S—Building Floor Plans and Subslab Soil Gas and Ambient Air Sampling SOPs

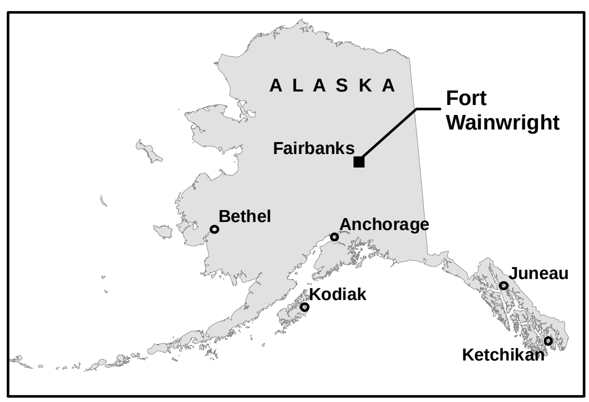
LEGEND

Project Location

Installation Boundary for Fort Wainwright

River

Railroad



Notes:
1. Imagery U.S. Army Corps of Engineers, May 2005.

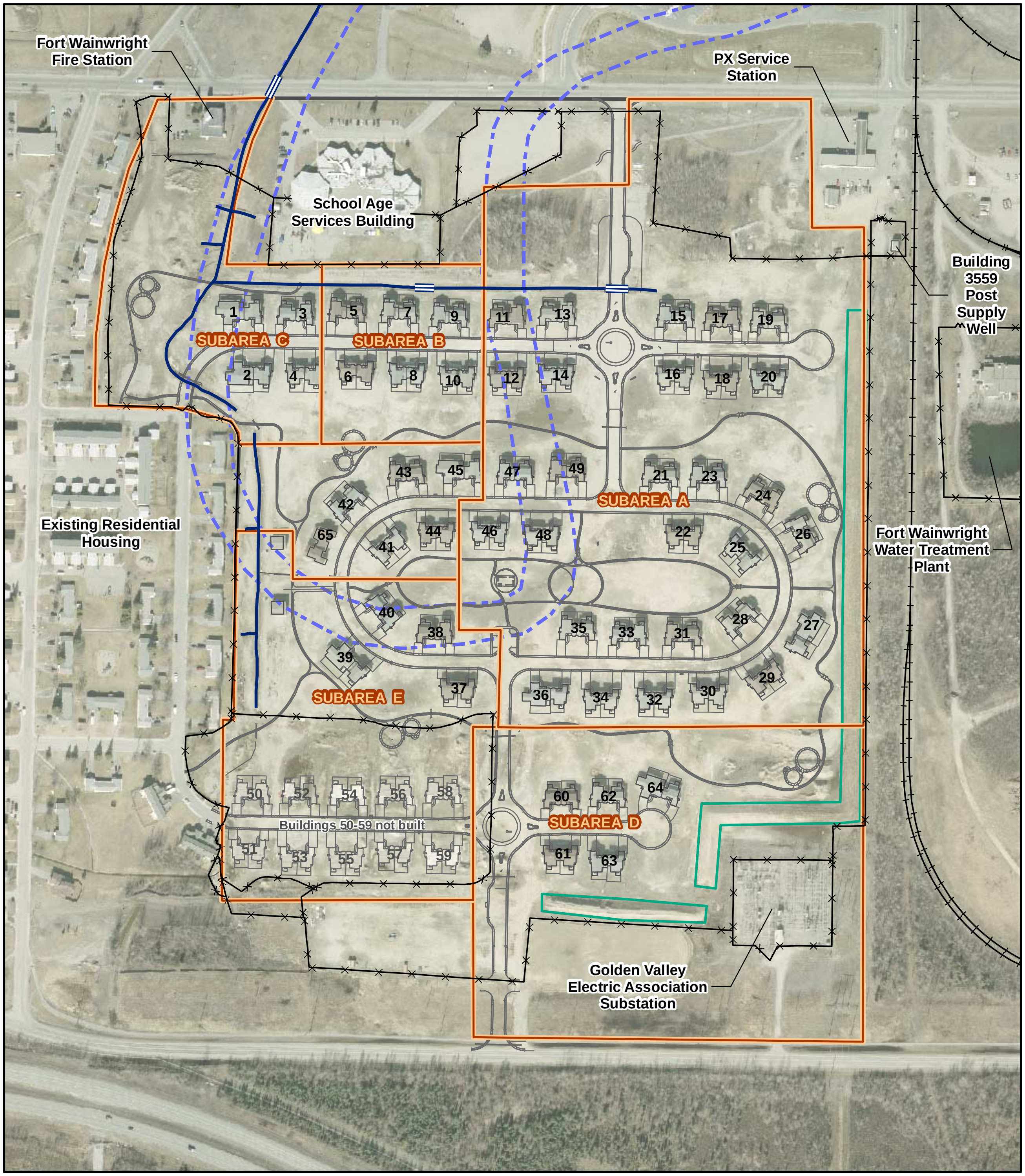
0 0.75 Miles

N

FIGURE 1-1
Former Communications Site Location Map
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\SIMBA\PROJ\USARMYCORPSOFENGINEE\357465TAKUGARDENS\GIS\MAPFILES\RI_2009\FIG1-1_SITELOCATION.MXD DMORIN1 4/28/2009

CH2MHILL



LEGEND

- Subarea Boundary
- Former Hoppe's Slough
- Sound Berm
- Drainage Swale
- Drainage Swale Culvert
- Security Fence
- Railroad
- Infrastructure for Taku Gardens

0 400
Feet

N

FIGURE 1-2
Taku Gardens Subdivision
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\SIMBA\PROJ\USARMYCORPSOFENGINEE\357465TAKUGARDENS\GIS\MAPFILES\RI_2009\FIG1-2_TAKUGARDENS_SUBDIVISION.MXD
DMORIN1 4/29/2009

CH2MHILL

SECTION 2

Site Description

This section describes the physical characteristics, operational history, and investigation history of the FCS.

2.1 Physical Characteristics of the Study Area

This section describes the physical characteristics of the FCS, including climate, topography, geology, hydrology, hydrogeology, demographics and land use, and ecological setting.

2.1.1 Climate and Weather

Fort Wainwright is in the continental climate zone of interior Alaska. This zone is generally characterized by extreme summer and winter temperatures and light precipitation. Surface winds are generally light (Selkregg, 1976). Average monthly mean temperatures range from a minimum of -18.7°F in January to 72.3°F in July. The area is classified as semiarid, with an average annual total precipitation of approximately 10.5 inches, including an annual average snowfall of 67 inches. The preceding data are derived from 1949 to 2005 statistics for Fairbanks, as reported by Western Regional Climate Center (2009).

During most of the year, prevailing winds are from the north at an average 5.15 mph. However, in June and July, winds are typically from the southwest at an average of 6.9 mph (Ecology and Environment, Inc., 1993a). Winds are strongest in May, at an average of 7.7 mph. Because of generally low wind speeds, moderate to heavy ice fog is prevalent in the area during cold weather (HLA, 1996.)

2.1.2 Site Features and Topography

Features at the FCS include the 55 residential buildings and two mechanical buildings near the western edge of the housing area. The following structures are adjacent to the FCS (Figure 1-2):

- Residential housing along the western side
- Other structures, including a fire station, the SAS building (with playground), and a gas station along the north side
- The FWA water treatment building and water supply wells at Building 3559 near the northeast corner
- Railroad tracks running parallel to much of the eastern edge
- A Golden Valley Electric Association electrical substation in the southeast corner of the FCS

Fort Wainwright is within two different topographical areas, the Tanana-Kuskokwim Lowlands and the Yukon-Tanana Uplands. The Main Post, which includes the FCS, is within the Tanana-Kuskokwim Lowlands, characterized by relatively flat terrain, with a typical elevation of about 450 feet above main sea level. The northern portion of the Main Post falls more in the Yukon-Tanana Uplands and has higher terrain, characterized by large rolling hills with elevations rising to above 1,000 feet above mean sea level (Oasis, 2007).

The FCS is characterized by relatively flat terrain, as is typical of the topographic area of Fort Wainwright. Most of the topographic relief at the FCS is the result of man-made features and include sound berms, the former Hoppe's Slough, and drainage swales. Topography of the FCS is shown in Figure 2-1.

A sound berm was constructed to reduce the noise from passing trains along the east and south sides of the housing area. There is a man-made drainage swale along much of the western and northern edges of the FCS. The swale carries stormwater and meltwater beyond the FCS boundary during heavy runoff periods. The sound berms and drainage swale can be seen in Figure 1-2.

Hoppe's Slough, a former meander channel, or oxbow, of the Chena River, curves through the middle of the FCS. As shown by the blue lines in Figure 1-2, the now-filled meander enters the north of the FCS and continues south, approximately 1,500 feet, where it curves around along the western edge of the FCS and exits again at the north. The footprint of the slough and a second meander south of the slough were identified in historical aerial photographs from 1948 and were partially visible in the late 1960s (Oasis, 2007). Historical photographs document the filling of the former meander channels as the area was developed. A geophysical survey performed in May 2004 indicated the material used to fill the slough included metallic objects (Oasis, 2007).

2.1.3 Geology and Soils

Fort Wainwright and the adjacent Fairbanks area are part of the Highlands Area of the Interior Alaska and Western Alaska Physiographic Province. This province is underlain by metamorphic rocks of the Yukon-Tanana Terrain. The metamorphic rocks west of Fort Wainwright are known as the Birch Hill Sequence and are approximately 400 feet below the floodplain of the Tanana and Chena rivers.

Overlying the Birch Hill Sequence is as much as 400 feet of fluvial deposits known as the Chena Formation. These alluvial sediments aggraded primarily from net deposition from the Tanana River (Anderson, 1970; Pewe et al., 1976; Nelson, 1978).

Fort Wainwright is underlain by soil and unconsolidated sediment that consists of silt, sand, and gravel, ranging in thickness from 10 feet to more than 400 feet above bedrock. A 5-foot-thick surficial layer of fine-grained soil overlies the deeper alluvial deposits. Alluvial floodplain deposits underlay the surface soils and consist of varying proportions of sand and gravel, which are commonly layered.

Where present, permafrost forms discontinuous confining layers that influence groundwater movement and distribution. The depth to permafrost, when present, generally ranges from 2 to 40 feet bgs, but permafrost on Fort Wainwright has been measured as deep as 150 feet bgs. The greater depths are found on cleared and developed land surfaces, where thermal degradation of underlying permafrost occurs. Regionally, the thickness of the permafrost intervals varies from about 5 to 275 feet. The seasonal frost layer (or active layer) varies between 2 and 12 feet thick (Ecology and Environment, Inc., 1993b).

Soil borings drilled during the RI and previous investigations indicate that soil at the FCS consists generally of sandy silt nearest the surface changing to sand and sand with silt and gravel at around 8 to 10 feet bgs. Permafrost has only been reported in borings advanced in the southeastern portion of the FCS.

2.1.4 Hydrology

Fort Wainwright lies entirely within the Tanana River drainage basin. The Tanana River, a major tributary of the Yukon River, flows east to west, approximately 3 miles south of the Fort Wainwright main cantonment area, encircling the northern and eastern boundaries of the Tanana Flats Training Area (Oasis, 2007).

Fort Wainwright also lies within the floodplain of the Chena River, a tributary of the Tanana River. The Chena River lies 1,500 feet north of the FCS and drains an area of approximately 2,000 square miles. It meanders westward through the Main Post, forming several oxbows, flowing into the Tanana River approximately 8 miles west-southwest of Fort Wainwright (ATSDR, 2003). The Chena River is an influent system for most of the year; when the river is at normal to low stages and groundwater is flowing into it. During high stages, because of melting snow and periods of high rainfall, the surface water discharges into groundwater. The banks of the Chena River have a capacity of 12,000 ft^3 of water per second (Oasis, 2007).

Many creeks and smaller rivers on Fort Wainwright eventually flow into the Chena or Tanana Rivers. None of the creeks or small rivers is within the FCS, nor are there any other permanent surface water bodies at the FCS. However, human-made drainage swales have been installed along the west side between the existing housing on White Street and the new Taku Gardens housing, and also along the northwest section, as shown in Figure 1-2. The combined swale exits the FCS to the north, running west of the SAS building. After meandering through the new hospital grounds and other properties, runoff from the FCS area may join overland flow that eventually empties to the Chena River approximately 1,500 feet north of the FCS. The FCS swales are believed to contain flowing water only for a short time each year during periods of heavy spring runoff and summer storms (CH2M HILL, 2008d).

2.1.5 Hydrogeology and Groundwater Use

The main aquifer in the Fort Wainwright area is the Tanana Basin alluvial aquifer, a buried river valley. This aquifer ranges from a few feet thick at the base of Birch Hill to at least 300 feet thick under the main cantonment area of the Post. The aquifer can reach a thickness of 700 feet in the Tanana River valley.

Groundwater movement between the Tanana and Chena Rivers generally follows a northwest regional direction, similar to the flow direction of the rivers. Seasonal changes in groundwater flow directions of up to 180 degrees are not uncommon adjacent to the rivers because of the effects of changing river stages in the Tanana and the Chena Rivers. Groundwater levels near the Chena River fluctuate greatly owing to river stage and interactions with the Tanana River. Typically, groundwater levels rise during spring break-up and late summer runoff and drop during fall and winter, when rainfall decreases and precipitation becomes snow.

The Tanana Basin alluvial aquifer beneath Fort Wainwright consists of deposits of the Chena Formation that vary in texture from sandy silt to coarse sandy gravel. The Chena Formation has a relatively high horizontal hydraulic conductivity in this area, estimated to be as high as 600 feet per day, and the vertical hydraulic conductivity has been estimated to be approximately 30 feet per day (USGS, 1996). The Chena Formation deposits are extensive and, thus, provide a large capacity for groundwater storage.

Groundwater in the Tanana–Chena floodplain is considered to be generally unconfined in permafrost-free areas. In wells drilled through the permafrost, however, the aquifer exhibits the characteristic of a confined aquifer. Here the groundwater rises to levels above the deepest extent of the permafrost, which acts as a confining layer. The fact that these levels are similar to those of wells completed in unfrozen alluvium supports the interpretation that the basin alluvium is a single-unit aquifer (USACE, 1991). Rates of movement for water and contaminants in frozen, porous soils depend on the overall temperature of the system, thermal gradient, occurrence of interconnected films of unfrozen water, and general continuity of the permafrost. Previous studies indicate that the permafrost containing large, interconnected films of unfrozen water is most likely to be composed of fine-grained materials (silt and clay sizes). When encountered, permafrost should not be regarded as an impermeable material, but rather as a material of very low hydraulic conductivity (Sloan and van Everdingen, 1988). Permafrost has been found only in soil borings advanced in the southeastern portions of the FCS, and therefore it does not influence groundwater flow at the FCS.

Groundwater is the only source of potable water used at Fort Wainwright and in the Fairbanks area. Approximately 95 percent of the potable water on Fort Wainwright is supplied through a single distribution system fed by two large-capacity wells in Building 3559 (Figure 1-2). These wells are installed to a depth of approximately 100 feet bgs with a screen interval of 60 to 80 feet bgs. These wells provide an average of approximately 59.2 million gallons of water per month to the FWA water treatment plant for processing and distribution (based on average water production for the period January 2005 through August 2010, as shown in Table 2-1 and detailed in Appendix B). This period includes the July 2008 through August 2009 Iraq deployment, which reduced the population of Fort Wainwright by about 25 percent. However, as indicated in Table 2-1, water use did not change over the deployment period. Note that the flowmeter transmitters used in the calculation of monthly water production volumes were replaced in early 2009. Recent testing has shown that the new flowmeters underreport flow volumes by about half; consequently, the water-plant-reported values for March 2009 through August 2010 are double those listed in the water plant reports provided in Appendix B. The water production system at Building 3559 has a theoretical maximum production capacity of 2,400 gpm; however, this rate is attained only during short-term tests of the system. Average monthly pumping rates for the period January 2005 through August 2010 were between 294 and 2,167 gpm, with an average pumping rate of 1,327 gpm.

In addition to the main drinking water supply wells, five emergency standby supply wells are located around the cantonment area. These wells are completed at depths of between 80 and 120 feet bgs and are capable of pumping approximately 250,000 gallons per day per well.

Groundwater conditions at the FCS have been characterized by 85 monitoring wells screened in the upper part of the aquifer and four monitoring wells screened in deeper portions of the aquifer.[1] Table 2-2 lists monitoring well construction details for the wells in the FCS, and Figure 2-2 shows the well locations. Groundwater elevation data indicate that groundwater flow is to the north, toward the Chena River (Figure 2-2). A table listing depth to groundwater measurements and calculated groundwater elevations is provided in Appendix E (Table E-12c). A pumping test was conducted in 2007 to update the groundwater flow model for Fort Wainwright and to better understand the effects on groundwater flow in the FCS of pumping from the water supply wells in Building 3559. Two pumping rates, 1,000 and 1,700 gpm, were modeled based on the approximated range of monthly production rates for 2005 and 2006. Detailed monthly production data were not available at the time; however, a review of the production rate data in Table 2-1 indicates that this range is still reasonable; the average pumping rate (1,327 gpm) is about halfway between the two modeled capture zones, and the 1,700-gpm rate was exceeded only three times in almost 5 years of operations. Plate 1 shows the estimated capture zone at 1,000 gpm in brown, and at 1,700 gpm in blue. The hydraulic conductivity derived from analysis of the pumping test (1,400 feet/day) was used in the capture zone calculations.

An analysis to evaluate the sensitivity of the simulated extent of the hydraulic capture zone to the assumed aquifer hydraulic conductivity was conducted in 2010. Two scenarios were run: a simulation where the hydraulic conductivity was half of that used in the calibration model (700 feet/day), and a simulation where the hydraulic conductivity was double that used in the calibration model (2,800 feet/day). The results of the modeling analysis suggest that the extent of hydraulic capture generated by operating the Building 3559 water supply well at the upper-range production rate (1,700 gpm) extends into a very limited area on the eastern edge of the FCS. The extent of the simulated 1,700-gpm capture zone, assuming a 1,400 feet/day hydraulic conductivity, is likely a worst-case scenario, or in other words, as large as the capture zone generated by the production well is likely to be. The groundwater model and the results of the sensitivity analysis are presented in Appendix B.

Concerns have been raised about whether increased water demand caused by occupation of the Taku Gardens subdivision might necessitate consistent operation of the water pumps at rates that could result in a sustained, long-term production rate exceeding 1,700 gpm. Current per capita water use at Fort Wainwright is about 159 gallons per person per day. This is consistent with nationwide per capita water demand, which is estimated to be about 183 gallons per person per day, including personal, industrial, and municipal use (AWWA, 2010). Assuming that Taku Gardens is fully occupied, with each of the 54 buildings occupied by two families of five each (10 people per building), the water needs for the additional 540 people would be about 86,000 gallons per day, which translates to an additional 60 gpm in the pumping rate. The resulting average rate (1,386 gpm) is still well below the 1,700-gpm upper range modeling rate. The population of Fort Wainwright would have to increase by more than 3,370 people in order to necessitate consistent pumping at the 1,700 gpm rate.

[1] There are now 88 wells at the FCS because MW-07 was decommissioned in 2009 to allow for excavation near Buildings 15 and 17.

2.1.6 Demographics and Land Use

Among the major active units at Fort Wainwright is the 172nd Stryker Brigade Combat Team. Subordinate commands include the 2nd Battalion, 1st Infantry Regiment; 1st Battalion, 17th Infantry Regiment; 4th Battalion, 11th Field Artillery and 123rd Aviation Regiment; 172nd Brigade Support Battalion; and 4th Squadron, 14th Cavalry Regiment. Altogether, approximately 7,700 Army personnel and 8,200 family members are stationed at Fort Wainwright. Roughly 1,250 civilian jobs with the Army or DOD also contribute to the workforce. The Post provides housing for approximately 1,600 families, with the remainder of the personnel living off-Post, often in nearby Fairbanks (U.S. Army Garrison, Alaska, 2006).

The Post provides a variety of onsite services and amenities for its personnel, including child care, a commissary/post exchange, vehicle maintenance facilities, a library, and Bassett Army Hospital. Children of grade-school age attend schools that are part of the Fairbanks school district. For leisure time, Fort Wainwright also provides a variety of both indoor and outdoor activities ranging from bowling and ice skating to skiing, golfing, and boating (U.S. Army Garrison, Alaska, 2006).

2.1.7 Ecological Setting

Fort Wainwright lies in the boreal forest ecosystem typical of the broad geographic lowland that covers interior Alaska. Vegetation and wildlife that characterize the boreal forest ecosystem of Fort Wainwright are discussed in the following subsections.

The FCS was cleared in 2005 in preparation for the construction of the Taku Gardens housing development. Since then, much of the area has been subject to traffic consisting of heavy vehicles and earth-moving equipment, resulting in little vegetation regrowth. The areas disturbed less recently, however, such as those along fence lines and in the large open area north of the main housing area and west of the main north-south road, have experienced some regrowth of herbaceous plants and fast-growing saplings such as poplars. These areas may provide some limited habitat for rodents, insects, and birds. Larger mammals, such as moose, are restricted from the FCS by the 8-foot perimeter fence, though smaller predators such as foxes may find (or create) gaps large enough to gain access. When the FCS is revegetated or the fence is removed, or both, the area will reintegrate with the existing Fort Wainwright ecosystem.

Vegetation

Vegetation distribution in the boreal forest is determined by several factors, including slope, aspect, history of fire and other disturbances, and the hydrologic regime, specifically, presence or absence of permafrost.

Upland vegetation of the boreal forest, such as that found in the vicinity of the FCS, is characterized by spruce-hardwood stands that occur on warm, dry, south-facing hillsides and adjacent to rivers where permafrost is absent. Dominant tree species are white spruce (*Picea glauca*) and paper birch (*Betula papyrifera*); common shrubs include prickly rose (*Rosa acicularis*), Labrador tea *(Ledum groenlandicum*), buffaloberry (*Shepherdia canadensis*), high bush cranberry (*Viburnum edule*), and several species of willow (*Salix* spp.) As a result of fires or other disturbances, the spruce-hardwood forest may be characterized by other dominant tree species under various stages of forest succession. Quaking aspen (*Populus* *tremuloides*) appears in upland areas on south-facing slopes following fire and an initial willow stage. Paper birch is the common invading tree after disturbance on east- and west-facing slopes, and occasionally on north slopes and flat areas. Balsam poplar (*P. balsamifera*) invades sandbars on floodplains and glacial outwashes (HLA, 1996).

There are no wetlands on or adjacent to the FCS.

Fish and Wildlife

Upland vegetation provides terrestrial habitat for large numbers of birds, mammals, and insects. Rivers, channels, and ponds provide aquatic habitat for various fish species, waterfowl, and benthic organisms. This section discusses common terrestrial and aquatic wildlife known at Fort Wainwright.

Terrestrial Wildlife. Terrestrial wildlife species at Fort Wainwright include a variety of mammals and birds. Of the 36 species of mammals listed by Kerns (1993) as potentially occurring at Fort Wainwright, 17 are indicated as common inhabitants. Moose (*Alces alces*) are probably the most abundant and widespread large mammal in the area, feeding primarily on willows and other shrubs. Although black bear (*Ursus americanus*) and grizzly bear (*U. arctos*) have been sighted on the Post, their occurrence within the cantonment area is considered rare to very rare. The red fox (*Vulpes vulpes*) is the most common of the canids; grey wolf (*Canis lupus*) and coyote (*C. latrans*) are considered rare to uncommon. Mammals commonly found at Fort Wainwright include shrews (*Sorex* spp.), pine martens (*Martes americanas*), woodchuck (*Marmota monax*), red squirrel (*Tamiasciurus hudsonicus*), beaver (*Castor Canadensis*), deer mouse (*Peromyscus maniculatus*), lemming (*Lemmus trimucronatus*), and snowshoe hare (*Lepus americanus*). Several species of vole (*Microtus* spp.) inhabit the area; the northern red-backed vole (*Clethrionomys rutilus*) is considered the most common small mammal at Fort Wainwright (Kerns, 1993).

More than 150 bird species, including waterfowl, raptors, game birds, and perching birds, are known to migrate through or reside in the Fairbanks area (Kerns, 1993; Spindler, 1976). Breeding waterfowl species include mallard (*Anas platyrhynchos*), pintail (*A. acuta*), green-winged teal (*A. crecca*), American widgeon (*A. americana*), northern shoveler (*A. clypeata*), rednecked and horned grebes (*Podiceps grisegena* and *P. auritus*), lesser scaup (*Aythya affinis*), and bufflehead (*Bucephala albeola*). The only resident hawk is the northern goshawk (*Accipiter gentilis*), but several others, including sharp-shinned (*A. striatus*), red tailed (*Buteo jamaicensis*), and marsh hawk (*Circus cyaneus*), nest and breed in the area. Bald eagle (*Haliateetus leucocephalus*) nesting sites are known to occur along the Tanana River (HLA, 1996).

Spruce grouse (*Falcipennis canadensis*), ruffed grouse (*Bonasa umbellus*), and willow and rock ptarmigan (*Lagopus lagopus* and *L. mutus*) are year-round residents that winter on willow, birch, and spruce buds and berries left over from the past summer. Other common resident birds include the rock dove (*Columba livia*); great horned, boreal, and hawk owls (*Bubo virginianus*, *Aegolius funereus*, and *Surnia ulula*); hairy and downy woodpeckers (*Picoides villosus* and *P. pubescens*); the gray jay (*Perisoreus canadensis*); black-capped and boreal chickadees (*Poecile atricapillus* and *P. hudsonicus)*; the northern shrike (*Lanius excubitor*); and the pine grosbeak (*Pinicola enucleator*) (HLA, 1996).

Reptiles are absent from interior Alaska, and amphibians are rare because few have adapted to the long, harsh winters and dry summers. Only the wood frog (*Rana sylvatica*) is known to occur throughout most of the state, including the Fairbanks area (Hodge, 1976).

Terrestrial invertebrates present in the area include mosquitoes, flies, ants, bees, wasps, beetles, spiders, mites, and nematodes. Much of the diversity of birds in summer depends on the abundance of insects, spiders, and mites for food. The saw fly, which feeds on willows, is one of the most numerous species of insects in Alaska (Selkregg, 1976).

Aquatic Wildlife. The Chena River, approximately 1,500 feet downgradient of the FCS, is an important aquatic habitat and sport fishery. The Chena River supports numerous fish species, including arctic grayling (*Thymallus arcticus*), burbot (*Lota lota*), humpback whitefish (*Coregonus pidschian*), sheefish (*Stenodus leucichthys*), lake chub (*Couesius plumbeus*), least cisco (*Coregonus sardinella*), longnose sucker (*Catostomus catostomus*), northern pike (*Esox lucius*), round whitefish (*Prosopium cylindraceum*), slimy sculpin (*Cottus cognatus*), and arctic lamprey (*Lampetra japonica*). Anadromous species that migrate upstream from the ocean to spawn in the waters of the Chena River include chum salmon (*Oncorhynchus keta*), silver salmon (*O. kisutch*), and the largest of all salmons, the king salmon (*O. tshawytscha*) (HLA, 1996).

2.1.8 Threatened, Endangered, and Sensitive Species

To identify any potential impact on federal, state, or otherwise listed sensitive species, Fort Wainwright's *Integrated Natural Resources Management Plan* (INRMP) (U.S. Army Garrison, Alaska, 2006) was examined and the Alaska Natural Heritage Program (AKNHP) was contacted to determine whether any such species may be found or have been documented on Fort Wainwright.

The AKNHP maintains a statewide database of sensitive species for Alaska, including the locations where the species have been sighted or collected. In addition to federally threatened and endangered species, the sensitive species catalogued by the database include candidate species for threatened or endangered listings and species that do not have regulatory status, but are considered of special concern by the state or scientific community. Although not required by law, under its INRMP, the U.S. Army Garrison, Alaska, resolves to work with state and federal entities to manage sensitive species on Army land. The INRMP includes lists of specific sensitive plant and animal species and notes, which have been confirmed on Fort Wainwright.

Sensitive Animal Species

According to both the INRMP and AKNHP, there are no known federally listed threatened or endangered animal species on Fort Wainwright (U.S. Army Garrison, Alaska, 2006; Lenz, 2009).

The following bird species recognized as state species of concern have historically been recorded within a 5-kilometer radius of the site by the AKNHP or have been confirmed on Fort Wainwright (U.S. Army Garrison, Alaska, 2006; Lenz, 2009):

- American peregrine falcon (*Falco peregrinus anatum*), downlisted from the Alaska endangered species list, still considered rare or uncommon in the state

- Arctic peregrine falcon (*F. p. tundrius*), downlisted from the Alaska endangered species list, Alaska species of special concern
- Northern goshawk, an Alaska species of long-term concern
- Olive-sided flycatcher (*Contopus cooperi*), an Alaska species of long-term concern
- Townsend's warbler (*Dendroica townsendi*), an Alaska species of long-term concern
- Blackpoll warbler (*D. striata*), an Alaska species of long-term concern
- Gray-cheeked thrush (*Catharus minimus*), an Alaska species of long-term concern

According to the INRMP, the American peregrine falcon, olive-sided flycatcher, gray-cheeked thrush, Townsend's warbler, and blackpoll warbler have been confirmed on Fort Wainwright (U.S. Army Garrison, Alaska, 2006). Descriptions of preferred habitat for these species can be found on the Alaska Department of Fish and Game website (http://www.adfg.state.ak.us/special/esa/speciesconcern.php) and AKNHP website http://aknhp.uaa.alaska.edu/zoology_Birds_track08_PASSERIFORMES.html). For the above species, nesting and foraging habitat includes forested areas (coniferous, deciduous, and old growth), cliffs adjacent to water bodies, open tundra, forested areas adjacent to open areas or water bodies, tall shrub areas in taiga, and ecotones between treeline and coastal or upland taiga. None of the habitats described by these resources fit the description of a recently constructed or fully established housing area; therefore, these species are not likely to occur at the FCS.

Sensitive Plant Species

The INRMP and AKNHP indicate that there are no known federally listed threatened or endangered plant species on Fort Wainwright (U.S. Army Garrison, Alaska, 2006; Lenz, 2009).

AKNHP provided a list of six sensitive plant species it has recorded as currently occurring in the Fort Wainwright area. Of these six species, most tend to be associated with either moist areas or shorelines and would not be expected to occur near the FCS. Two species, Okhotian bugseed (*Corispermum ochotense var. alaskanum*), a subspecies considered globally imperiled, and white-tinged sedge (*Carex peckii*), a species of long-term concern globally and possibly rare or uncommon in Alaska, with cause for long-term concern, are believed by AKNHP to have potential to occur in the general vicinity of the FCS (Lenz, 2009). Both species have an affinity for sandy soils; the Okhotian bugseed is recorded as preferring shores and waste places, and the white-tinged sedge is partial to open woodland. Because the habitat at the FCS is highly disturbed, the likelihood of either species occurring there is probably very low.

2.2 Operational History

During decades of military use at Fort Wainwright, routine operations and storage practices resulted in accidental releases of chemicals to the ground and underlying groundwater or nearby surface water. Former waste disposal practices were also responsible for releases to the environment.

A limited number of written records describing activities specifically occurring at the FCS during the course of its use are available. Much of what is known about the FCS has been inferred from examining and comparing historical photographs (dating from 1947 to the present), the 1958 Fort Wainwright "Master Plans," past geographical surveys, and military operations concurrent with similar missions conducted at other locations.

The area historically defined as the FCS has a history of mixed uses, including the following:

- Equipment salvage/reclamation
- Disposal of debris/salvage material in the former Hoppe's Slough oxbow that extends through the site, in trenches in the salvage yard area, and possibly in other local depressions
- Garden plots
- Possible firefighting-training activities, as evidenced by what appear to be fire pits and a partially disassembled aircraft in historical aerial photographs
- Barracks and company headquarters extending into the northwest corner of the site
- Possible small arms ammunition storage
- Communications and radar systems

The overall history of FCS use and development is summarized in Table 2-3. Site use and surface conditions during the 1940s, 1950s, and 1960s are depicted in aerial photographs and maps included in Appendix C.

As shown in the historical photography, a salvage yard was active in the northeast portion of the FCS from the 1940s to 1960s. During this time, the eastern portions of Hoppe's Slough were filled, possibly with debris from the salvage yard, and accumulations of drums and debris are visible near the current locations of Buildings 11 through 19, 21 through 29, 31 through 33, 35, 47, 48, and 49 (Figures C-1 and C-2). Photographs from 1960 show stockpiles of drums, fire-training burn areas, and the remains of a wrecked U.S. Air Force aircraft in the area between the current locations of Buildings 16, 21, and 49 (Figure C-3).

During the 1950s and 1960s, a concrete batch plant and railroad spur were operated in the northeast corner of the FCS in the area between the current locations of Buildings 15, 17, and 19 and the post exchange (PX) service station (gas station) (Figure C-2). Some former salvage yard stockpiling activities also occurred in this area.

By 1956, a large, white structure was constructed and the ground surface was cleared near the planned locations for Buildings 50 through 52 for operation of communication and radar systems (Figure C-2). Communication and radar system activities and infrastructure occurred close to future discoveries of PCB-contaminated sources near Buildings 50 and 52. Also by 1956, Company Headquarters and barracks buildings were present in the northwest portion of the FCS. These facilities had been demolished by 1960. Operations and decommissioning activities of these former buildings may explain many of the smaller buried debris and contaminant sources discovered near Buildings 1 through 4, 7, 9, 11, 12, and 45 (Figure C-3).

In 1960, the entire eastern and southern portions of Hoppe's Slough appear to have been filled. The drum and debris investigations conducted near Building 48 during 2007 and 2008 (discussed in Section 4) were focused on the southeast bend of the former slough channel that was filled during this timeframe. By 1967, the entire FCS was clear of structures, except for the newly constructed SAS building (Figure C-4).

A detailed review and discussion of the available historical aerial photographs are provided in the first phase of the Preliminary Source Evaluation (PSE I) (Oasis, 2007). PSE I divided the FCS into five subareas (Subareas A through E) based on the historical use, a review of historical aerial photographs and maps, and the types of contamination and debris encountered. Overall, the former locations of the salvage yard and Hoppe's Slough channel correlate well with the occurrence of buried debris at the FCS. However, with the exception of PCB contamination in Subarea E and munitions-related items intermixed with debris in Subarea A, the initial subarea designations do not correlate well with distinct sources or zones of contamination and are useful only as general geographic references.

2.3 Site Development and Investigation Summary

This section briefly describes the development and investigation history of the FCS and Taku Gardens housing project. The general chronology of development and investigation beginning with development of the FCS as a future housing project and continuing through completion of the RI is depicted in Figure 2-3.

2.3.1 Initial Construction and Investigation Activities (2003–2005)

Investigation of the FCS began in 2003, following selection of the land for construction of future military housing. The intent of the initial investigations that included geophysical, geotechnical, and some subsurface soil sampling components, was to support construction activities. Available sample information and analytical results for samples collected during these investigations are provided in Appendix E (field records and maps) and Appendix I-1 (analytical results by investigation, medium, and year, as applicable). The analytical results for the period 2003 to 2004 are provided in Table I1-1, and the results for 2005 are provided in Tables I1-2a through I1-2j.

During these early investigations, the first indications of significant buried debris, munitions-related items, and contaminated soils were identified at the FCS. Initial geophysical investigation of the FCS began in October 2003 when the Cold Regions Research and Engineering Laboratory (CRREL) conducted a limited electromagnetic (EM) geophysical survey in the northeast "snow dump and site trails" portions of the FCS where historical aerial photographs showed debris piles (Oasis, 2007). The 2003 survey identified a number of geophysical anomalies at the site; this led to the May 2004 comprehensive EM and magnetometer (MAG) geophysical survey of the entire FCS by R&M (2004). The 2004 geophysical survey identified widespread surface anomalies at the FCS, as well as large areas of buried metal debris within the southern portions of Hoppe's Slough and in the vicinity of the former salvage yard (Figure E-1). Soil contamination included PCBs, which were discovered in the southwest corner of the site near Building 51. A follow-up investigation in March 2005 failed to confirm the presence of PCBs in this location (North Wind, Inc., 2005). Because PCBs appeared to be absent, foundation excavation and housing construction activities began at the new Taku Gardens family housing development in April

2005. Foundation and utility trenches were excavated between April and August 2005. Field screening for petroleum contamination was conducted during excavation activities, and excavated soil and encountered debris were stockpiled on the FCS.

In June 2005, a solventlike odor was reported by the construction contractor near Building 52, and petroleum contamination was discovered in the vicinity of Buildings 5 through 9 during foundation excavation and construction activities. Soil and groundwater samples were collected from these areas in late June and July 2006 (see Section 2.3.2), and were analyzed for PCBs and petroleum constituents. Chlorinated compounds were detected in soil samples from the Building 52 foundation excavation and from associated stockpiled soil. PCB concentrations as high as 111,000 milligrams per kilogram (mg/kg) were reported in samples collected from the Building 52 foundation excavation floor.

Following receipt of results from the initial Building 52 foundation excavation sampling, a PCB exclusion zone (EZ) was constructed around the vicinity of Building 52 (Plate 1). EPA and ADEC were informed about the investigation findings, and the agencies have been integrally involved in all site investigation activities since that time.

In late August 2005, an environmental site characterization focused on protecting site workers and nearby residents was initiated, and all construction work at the Taku Gardens family housing development was suspended. A press release was issued to the public, and a public meeting was held describing the construction shutdown and potential contamination concerns at the FCS (U.S. Army, 2005a, 2005b).

The late August 2005 site characterization focused primarily on PCB contamination concerns and included sampling surface soil from high-traffic construction areas and from temporary soil stockpiles; subsurface soil from soil borings; wipe samples from site equipment and structures, offsite (i.e., non-FCS) flower beds where soil from the FCS had been used, and an non-FCS utility excavation where FCS soil was used as backfill; and groundwater. Overall, the highest PCB contamination appeared to be restricted to the southern portion of the construction area in the vicinity of Building 52; however, PCBs were also detected at levels below EPA and ADEC cleanup levels at other locations of the FCS (North Wind, Inc., 2006). The 2005 effort concluded that additional site characterization and potential corrective action were necessary to address the PCB- and petroleum-contaminated soil discovered at the FCS (North Wind, Inc., 2006).

A TCRA of 186 cubic yards (yd^3) of PCB-contaminated soil from the original Building 52 foundation excavation was completed in September 2005. The contaminated soils were transported to an offsite approved facility for disposal by Emerald Services (U.S. Army Garrison, Alaska, 2007).

In addition, Shannon & Wilson continued to field screen and collect samples as part of the housing development construction contract until October 25, 2005; 87 soil samples were collected at a minimum rate of 1 sample for every 100 feet of trench/excavation. These samples were provided to North Wind, Inc., for subsequent PCB analysis to provide additional soil characterization and potential worker exposure evaluation (North Wind, Inc., 2006).

Petroleum constituents were detected in soil and groundwater samples collected in the Buildings 5 through 9 area, with diesel-range organics (DRO) concentrations in several samples exceeding the ADEC Method 2 cleanup levels (North Wind, Inc., 2006). The petroleum-contaminated soil at three locations in the vicinity of Buildings 5 through 9 was excavated by Shannon & Wilson in 2005, and was temporarily stockpiled on site before being transferred to long-term stockpiles at the DRMO yard (North Wind, Inc., 2006).

2.3.2 Preliminary Source Evaluation (2005 and 2006)

As a result of identifying PCBs in soil near Building 52 and reviewing findings from initial construction support investigations, the Army and regulatory agencies agreed that a PSE was required at the FCS. The PSE process is described in the Fort Wainwright FFA. The scope of the PSE was to evaluate releases or threatened releases of hazardous substances, pollutants, or contaminants from a source area with the potential to constitute a threat to the public health, welfare, or the environment. The purpose of the PSE was not to fully characterize the FCS, but to provide sufficient information to determine if an RI was required.

A review of all existing historical information on FCS activities, waste disposal practices, and prior investigations was undertaken during the first phase of the PSE (PSE I), which was conducted during the winter of 2005–2006. PSE I concluded that surface and subsurface soil in most areas of the FCS was potentially contaminated (Oasis, 2007). Only the southeast portion of the FCS, where potential impacts could not be fully determined, was excluded from this general conclusion.

During summer and fall 2006, the U.S. Army commissioned a second phase for the PSE (PSE II). PSE II focused on buried debris, soil, soil gas, stockpiles, and groundwater at the FCS. PSE II and other pre-RI sample locations are shown in Figures E-2, E-3, and E-4. The findings of the investigations are summarized below (detailed descriptions of PSE II activities were presented in the PSE II report (North Wind, Inc., 2007). Available sampling information is provided in Appendix E, and analytical results are presented in Appendix I.

Soil Piles and Debris Piles Findings

Potentially contaminated soil and debris removed during building foundation construction and utility trench excavation was stockpiled at the FCS. Soil and material obtained from the excavations were characterized based on photoionization detector (PID) readings, with an action level of 20 parts per million (ppm). Material exceeding the action level was excavated and further segregated into two types of stockpiles—one for material with readings between 20 and 100 ppm and one for material with readings greater than 100 ppm. Soil or material with PID readings greater than 100 ppm was considered petroleum-contaminated. Approximately 1,500 yd^3 of petroleum-contaminated soil were stockpiled at locations near the PX Service Station. In September 2005, this soil was tested for fuel analytes and PCBs, and then was transported and stored in three long-term stockpiles on the west end of the Defense Reutilization and Marketing Office (DRMO) Yard. Approximately 150 yd^3 of presumably POL-contaminated soil was transported to an offsite thermal treatment facility in Fairbanks. The remaining soil in the stockpiles was stored in the DRMO yard until 2008, when further characterization and final disposal occurred.

From June to August 2006, as part of the PSE II, North Wind, Inc., inspected 16 existing soil piles created during the utility and building foundation excavation. The piles were composed primarily of soil with some debris mixed in. Small to mid-sized excavators with thumb attachments were used to sort the piles. Each soil pile was inspected by removing soil and debris from the stockpile in approximately 6-inch lifts to enable thorough inspection. UXO and environmental technicians sorted each pile based on the type of material found (such as soil, drums, scrap metal, or concrete). On a few occasions, items with the potential to contain hazardous waste (for example, batteries and light ballasts) were found. Such items were placed into drums and eventually transferred to the Fort Wainwright RCRA facility contractor for proper disposal. All other stockpiled material was left in its original location.

In total, 97,100 ft^3 (3,600 yd^3) of soil were thoroughly sorted, visually inspected, field screened, and subsampled during PSE II to determine whether physical or chemical hazards were present. In general, volatile organic compounds (VOC), semivolatile compounds (SVOC), and metals were the most prevalent contaminants in the soil piles; however, explosive residues, PCBs, pesticides, and polynuclear aromatic hydrocarbons (PAH) were also detected (see Appendix I, Tables I1-3a and I1-3b). PCB contamination, Aroclor 1260, was detected in Soil Pile 17 at concentrations greater than 1 ppm, and metals constituents were detected at the highest concentrations in Soil Piles 11 and 17. Soil Pile 17 was immediately west of the known PCB contamination area, and its composition likely reflected conditions in that area.

A map showing the locations and names of soil and debris piles remaining onsite after the completion of the PSE II is provided in Figure E-5. Available sampling information is provided in Appendix E (maps and field records). Because the soil and debris piles represent material from the FCS that, prior to excavation and removal, could have acted as primary or secondary sources of COIs, the soil pile samples are considered part of the source characterization group, which is evaluated in Section 4. Detailed analytical results for the samples are presented in Appendix I, Table I1-3b.

Subsurface Environment Findings

The subsurface environment investigations conducted in the FCS have included both indirect (geophysical studies) and direct (test pits and exploratory excavations) activities, which identified areas of buried debris.

Geophysical Studies. The 2006 PSE I identified uncertainties and data gaps in the 2004 geophysical survey, including that a large area north-northwest of Buildings 1 through 4 had not been included in previous geophysical surveys. As part of PSE II, Sage Earth Sciences conducted EM, MAG, and ground-penetrating radar (GPR) geophysical surveys of approximately 25 acres of the FCS to assist in buried debris investigation and test pit activities (Sage Earth Sciences, 2007). A dense data set (approximately one measurement per square foot) was collected. Numerous magnetic anomalies were detected (see Figure E-6), and excellent correlation between the magnetic anomalies and the presence of buried ferrous debris was observed.

Test Pits. Site preparation activities, including clearing and grubbing, some utility construction, and limited debris removals, were performed starting in March and April 2004 by the Fort Wainwright Directorate of Public Works (DPW). As part of site preparation, two excavations were dug behind the PX Service Station in the northeast portion of the FCS, where large, car-sized pieces of metallic and miscellaneous debris were identified and removed (USACE, 2006). Suspected munitions-related items were identified during excavation, and military ordnance experts were contacted. Five potential DMM items and multiple munitions-related scrap items were identified and disposed of by U.S. Army EOD personnel (U.S. Army, 2004) (see also Section 6).

Buried debris in the vicinity of housing units was investigated during the 2006 PSE II. The primary method used to investigate the buried debris was to excavate small test pits focused on 30 general areas of interest determined on the basis of notes and photographs taken during the 2005 construction work, as well as on previous geophysical surveys. The locations of the 2006 PSE II test pits are shown in Figure E-7. During PSE II, UXO and environmental technicians visually inspected the debris that was encountered. Significant effort was made to identify any items that had the potential to be a source of contamination or other hazard. However, no effort was made to catalog all the debris items encountered; material that did not have potential to be a source of contamination or did not have the potential explosive hazard was generically categorized as "scrap."

"Scrap" is defined as debris that, had it been generated today, would not be regulated under RCRA or the Toxic Substances Control Act (TSCA). Typical scrap items include heavy equipment parts, vehicle parts, airplane parts, structural steel, and empty and crushed steel drums. The debris investigation confirmed earlier observations by the construction contractor that the majority of the material buried at the FCS is scrap metal. Sixteen of the 30 test pits, 3 of the 4 debris piles, and 4 of the 17 soil piles contained primarily scrap metal. It is important to note this because the primary objective of the PSE was to determine whether chemical or physical hazards were associated with the buried debris; material that clearly was not a potential source of contamination or that did not pose a physical hazard (such as an explosive) was not cataloged in notes or photographed.

"Waste" is defined as debris that if generated today would be or potentially would be considered regulated waste under RCRA or TSCA. Relatively few waste items were found during the debris investigation, with the exception of those found in Test Pit 14 near Building 49. In this location, an unknown number of drums were deeply buried. The operator was able to successfully remove two intact and full drums from the bottom of Test Pit 14. These drums were placed immediately into overpack containers and secured on the FCS for comprehensive characterization. These drums were removed solely to facilitate sampling in support of the FCS investigation. Because of the depth of the drum cache and the proximity to buildings and subsurface utilities, only a small area could be exposed, leaving the cache not fully characterized and the total number of drums remaining in the ground unknown. (Note that drums in this area were subsequently excavated in 2007.) Also, an organic odor was noted at a depth of approximately 10 feet bgs during the excavation.

Of the two waste drums exhumed from Test Pit 14, one drum was found to be partially filled with what appeared to be water and the second was found to be partially filled with sludge. Sample results from the liquid-filled drum indicated the presence of 2,4- and 1,3,5-trimethylbenzene, DRO, and naphthalene, as well as trace levels of a variety of other petroleum compounds and PAHs. Sample results from the sludge-filled drum indicated high levels of gasoline-range organics (GRO), DRO, and residual-range organics (RRO), as well as various benzene, naphthalene, cyclohexane, PAH, pesticide compounds, and metals. A complete list of the detected substances in each drum sample is provided in the PSE II report.

Concerns that radiologically contaminated materials may have been disposed of at the FCS (such as radium painted dials from aircraft or heavy equipment) were also investigated. A Ludlum scintillator detector was used by experienced radiological remediation field staff to scan and measure gross beta/gamma activity on an item of interest as necessary. Several measurements were performed on aircraft parts consisting of dials, fuel tanks, and other miscellaneous parts. All measurements performed at the FCS with the scintillator detector were below background count rates. Thus, no indication of radioactive material was detected at the site.

Because the soil and waste removed from the test pits may have been possible primary or secondary sources of COIs for the FCS, the ex situ test pit samples are considered part of the source characterization group, which is evaluated in Section 4 with detailed analytical results for the samples included in Appendix I, Tables I1-3a and I1-3b (headings in the Appendix I tables indicate the evaluation group assignment for each sample). A few subsurface samples were collected from the test pits in areas that were not later excavated. The results for these samples are considered in the nature and extent of contamination and risk assessment evaluations (Sections 5 and 7).

Munitions-Related Items. Eleven munitions-related items were unearthed by the Fort Wainwright DPW in spring 2004 during the limited debris removals performed in the northeast corner of the FCS behind the PX Service Station. The excavated debris included suspected munitions-related items, and military ordnance experts were contacted and were present during subsequent examinations of soil piles and excavations at the FCS. Additional munitions-related items were found during subsequent investigations in 2005 and 2006. The munitions-related items and DMM are described in Section 6 and copies of the EOD Reports are provided in Appendix J.

Note that the first of two M47-series dual-purpose bombs encountered had been crushed and either ruptured or punctured and could be verified as empty. However, the project UXO specialists determined that the items contained charged burster tubes with the potential to be intact. Because it was unknown whether the burster tubes presented an explosive hazard, precautions were taken to protect personnel from injury. Military EOD personnel later inspected the first M47 by x-ray and confirmed that the burster tube was intact.

During the course of the test pit activities, other items of interest were found, including numerous empty shipping tubes for 105-millimeter (mm) artillery rounds, empty shipping tubes for 2.36-inch rockets, empty ammunition cans, an M10 chemical smoke tank, 75-mm RR casings, and 57-mm RR casings. Non-energetic munitions debris (MD) items such as these were segregated during the excavation work and secured in drums. At the end of the test pit investigation, all MD items were properly certified and disposed of at the installation landfill.

The second M47 dual-purpose bomb unearthed in Test Pit 31 was found to be intact with liquid contents later characterized as water. Personnel from the U.S. Army TEU inspected the munitions using the Idaho National Laboratory's portable isotopic neutron spectroscopy (PINS) system and determined that the item could be safely transported and destroyed by conventional means.

Soil Findings

Soil samples were collected from soil borings distributed across the site to assist in characterization of possible petroleum and PCB contamination. Soil boring locations associated with the investigation are shown in Figure E-2. Borings in the northwestern and north-central portions of the FCS confirmed the presence of petroleum contamination. Available sampling information is provided in Appendix E. Analytical results for samples in areas or depths that were later reworked or excavated are evaluated as source material, whereas data for samples from areas and depths that were not reworked or excavated were considered representative of in situ conditions and are included in the evaluations of nature and extent of contamination and risk assessment are presented in Sections 6 and 7. Analytical results for the samples are presented in Appendix I, Tables I1-3a and I1-3b (headings in the Appendix I tables indicate the evaluation group assignment for each sample). As described in the investigation chronology, initial indications of PCB contamination in site soils were first discovered during the 2003–2004 USACE investigation (USACE, 2004a–d), but sitewide PCB sampling was not accomplished until after the Building 52 foundation excavation identified soil with PCB (Aroclor 1260) concentrations as high as 111,000 mg/kg (North Wind, Inc., 2006; Oasis, 2007).

In 2005, field screening with Ensys field test kits was used to supplement the offsite analytical laboratory data and provide quick results to the field team needed to make timely field decisions. Samples with positive PCB field-screening results were sent to the offsite laboratory for confirmation. The investigation found that the highest levels of PCB contamination occurred in the southern portion of the construction site near Building 52, but that low levels of PCBs (those below ADEC and EPA cleanup criteria) were present in soils across the FCS at depths ranging from 0 to 8 feet bgs (North Wind, Inc., 2006). All PCBs were identified as Aroclor 1260, with the exception of four results that were identified as Aroclor 1254. Aroclor 1254 was detected only in the Building 51 area of the PCB EZ. The results for equipment wipe samples, Building 52 stockpiled soil, and surface soil samples collected outside the PCB EZ indicated that low levels of PCB contamination were present and that equipment coming into contact with the contaminated soil from the PCB EZ might have spread contamination or become affected. Low levels of PCBs were detected on construction equipment and outdoor recreational (playground) equipment inside the Taku Gardens family housing development and in soil used to backfill the utility excavation in front of Building 4394, at the southwest corner of the FCS. Equipment with a positive result, regardless of level, was decontaminated before it was used again at the FCS. Contaminated backfill soil from Building 4394 was removed and placed within the Building 52 excavation and replaced with clean fill material. Results from the flower beds and pots samples also confirmed that contaminated soil had been used as potting soil. The contaminated flower pots and soil were removed and stockpiled with other PCB-contaminated soil within the Building 52 excavation.

A TCRA of 186 yd^3 of PCB-contaminated soil from the original Building 52 foundation excavation was completed in September 2005. The contaminated soils were transported to an offsite approved facility for disposal by Emerald Services (U.S. Army Garrison, Alaska, 2007).

In addition, Shannon & Wilson continued to field screen and collect samples as part of the housing development construction contract until October 25, 2005, 87 soil samples were collected at a minimum rate of 1 sample for every 100 feet of trench/excavation. These samples were provided to North Wind, Inc., for subsequent PCB analysis to provide additional soil characterization and potential worker exposure evaluation (North Wind, Inc., 2006).

The 2006 PSE II conducted by North Wind, Inc., included additional investigation of three areas for PCBs. A total of 202 soil borings and 539 samples were collected from the PCB EZ area, from the transformer service area (TSA), and at the southern sound berm and were analyzed for PCB contamination using field-screening test kits and offsite laboratory analysis. The test kits were able to conservatively distinguish areas of contamination containing greater than 1 ppm of PCBs in soil. In addition to the subsurface borings, 36 surface soil samples were collected in the PCB EZ area.

At the PCB EZ, one large area of contamination was delineated near Building 52. Six smaller, isolated areas of contamination were indicated to the north and west of the large contamination area. The PCB contamination was observed to be confined to the top 5 feet of the soil column in all soil samples collected within the PCB EZ. Sample results from the TSA indicated PCB detections from 1 to 5 ppm in six samples; however, it was unclear whether a significant area of PCB soil contamination existed at the TSA. At the southern sound berm, four field screening results indicated possible PCB contamination. Because split soil samples from the same four borings were reported as nondetect by the analytical laboratory, field test kit results for these four samples were attributed to false positive errors produced by the field test method. As a result, it was determined that data from the southern sound berm were insufficient to conclude whether PCB contamination existed in the area.

Groundwater Conditions

Characterization of site groundwater conditions began in July 2005, following discovery of petroleum contamination in soil in the north-central portion of the FCS and continued through completion of the PSE II investigation. Pre-RI well locations associated with each investigation are shown in Figure E-4. Available well construction and sampling information are provided in Appendix E. Due to the age of the samples, issues with detection limits relative to current screening criteria, and lack of sample coverage (see Section 3), the analytical results are not considered representative or usable for the nature and extent or risk assessment evaluations; however, the results are presented in Appendix I, Table I2-1a.

Three temporary groundwater monitoring wells (BH-6-GW, BH-7-GW, and BH-9-GW) were installed and sampled near Buildings 7 and 8 in July 2005. Petroleum-related constituents were detected in the groundwater samples collected from the wells, with DRO concentrations exceeding the 2005 ADEC Method 2 cleanup level of 1.3 milligrams per liter (mg/L) (North Wind, Inc., 2006).

Seven additional temporary wells (TW-1 through TW-7) and three permanent wells (MW01 through MW03) were installed at the FCS in September 2005. Groundwater samples were collected from each well and analyzed for VOCs, GRO, DRO/RRO, SVOCs, PCBs, pesticides, and metals. DRO, metals, and VOCs were detected in the groundwater samples, but all concentrations were below the 2005 ADEC cleanup levels (North Wind, Inc., 2006).

The PSE II included installation of seven temporary and ten permanent groundwater monitoring wells (MW04, MW05, MW06a, MW06b, and MW07 through MW12). Water levels in the 13 permanent monitoring wells, including the three wells (MW01 to MW03) installed during the 2005 field season, were monitored to determine groundwater flow conditions, and one round of groundwater sampling was conducted during the 2006 field season. The temporary wells were used only as piezometers to determine groundwater flow direction and to aid in determining the optimal locations for the permanent wells; no groundwater samples were collected from the temporary wells. Groundwater samples collected from MW01 through MW12 during PSE II were analyzed for PCBs, VOCs, SVOCs, GROs, DROs/RROs, pesticides, metals, mercury, anions, explosives, and dioxins/furans (see Appendix I, Table I2-1a).

Interpretation of the information gathered during the PSE II determined that the groundwater flow direction was approximately southeast to northwest (N44ºE) with a hydraulic gradient of 2.2×10^{-05} feet/foot (North Wind, Inc., 2007). The results of the PSE II groundwater investigation suggested that at least one area at the Taku Gardens family housing development (the north-central portion of the FCS) was affected by past practices. The PSE II concluded that the groundwater contamination in the north-central portion of the FCS was composed primarily of DRO, explosives, and at least one VOC (p-isopropyltoluene). The primary source area was suggested to be in the vicinity of Building 10 and MW12. The reported detections of explosive compounds in the north-central portion of the FCS were suspected to have been caused by analytical interferences from the high levels of petroleum compounds (North Wind, Inc., 2006).

Soil Gas Conditions

During September 2006, as part of PSE II, North Wind, Inc., conducted a passive shallow soil gas survey to determine whether prior use of the area had resulted in VOC impacts on soil gas. The soil gas survey was limited to a relatively small area of the FCS in the vicinity of known VOC contamination near Building 7 and the Test Pit 14 buried drum cache near Building 49. Passive shallow soil gas samples were collected on a grid pattern throughout the investigation area, with slight modifications to the grid based on access considerations. Figure E-3 shows the locations of the passive soil vapor sample locations. The grid of 36 passive soil vapor sample points was installed using direct-push technology to a depth of 8 feet bgs. After all wells had been installed, a passive Gore-Sorber™ soil gas sampler was placed within each soil gas point, allowed to equilibrate for 9 days, recovered, and submitted to an offsite laboratory for VOC analysis. Three classes of analytes were detected in the soil gas: petroleum constituents, chlorinated solvents, and chlorofluorocarbons (CFC) (North Wind, Inc., 2007). Petroleum constituents were ubiquitous in the soil gas and were detected in almost every soil gas sample. CFCs were also detected in nearly all sample locations; these detections were later determined to be most likely associated with materials used during housing construction. Chlorinated solvents, trichloroethylene (TCE), and tetrachloroethene (PCE) were detected at five sample locations near Buildings 4, 14, 45, 46, and 49. One location near Building 4 had the highest measured values for both petroleum constituents and PCE, suggesting a common source. In other areas, petroleum constituents, chlorinated solvents, and CFCs were not collocated; therefore, it was concluded that the petroleum, chlorinated solvents, and CFCs in these areas were derived from separate sources.

2.3.3 Remedial Investigation Activities (2007–2010)

As discussed in Section 2.3.2, investigations conducted in the FCS between 2003 and 2006 encountered a variety of contaminants in soil and groundwater, and identified a number of potential source areas associated with historical uses and past disposal practices. The RI was initiated in 2007 to collect sufficient data of appropriate quality to assess the nature and extent of soil and groundwater contamination at the FCS, determine whether other environmental media have been affected by contamination, conduct risk assessments, and support development of remedial alternatives. Fieldwork associated with the RI was conducted in 2007, 2008, 2009, and 2010. Figure 2-3 shows the relationships between pre-RI data, 2007–2010 RI data, and the objectives of the RI. Detailed information about 2007, 2008, 2009, and 2010 field work is provided in Appendix D and Appendix E.

2007 RI Field Activities

The RI Work Plan and amendments (CH2M HILL, 2007a–c, 2008d) described the data gaps and initial sampling activities to be completed during 2007.

The 2007 RI activities included the following:

- Characterization of soil piles for possible disposal at the Fort Wainwright landfill
- Assessment of soil conditions in the sound berms along the southern and eastern boundaries of the FCS
- Characterization of soil conditions throughout the FCS, including contaminant levels at the bottoms and sidewalls of excavations, following removal of PCB-contaminated soil, buried drums, and debris, and in soil borings
- Assessment of groundwater conditions and contaminant concentrations throughout the FCS
- Characterization of soil gas concentrations in open areas and beneath building foundations
- Characterization of sediment in drainage swales along the northwest boundary of the FCS

Table 2-4 provides an overview of the number and types of samples collected in and the analyses performed in 2007.

Soil Pile Characterization. At the beginning of 2007, many soil piles created during housing construction and utility trench excavation activities remained on the FCS. The objective of the soil pile investigation was to characterize the soil for possible disposal in the Fort Wainwright landfill. Stockpile soils with concentrations below the landfill acceptance criteria were to be used as cover in the landfill. Stockpile soils with concentrations above the criteria were to be processed and disposed of by the Fort Wainwright DRMO.

The primary method used to investigate the soil piles was multi-incremental (MI) soil sampling (ADEC, 2007). The soil pile characterization process involved comparing the MI sample results with the Fort Wainwright landfill screening criteria. The soils with concentrations below the criteria were considered suitable for use as cover material at the

Fort Wainwright landfill, and soils with concentrations above the criteria were required to be processed and disposed of by the Fort Wainwright DRMO.

Because the soil piles varied in volume from approximately 10 to several hundred yd^3, smaller piles were grouped into single MI decision units and larger piles were divided into multiple MI decision units. ADEC (2007) defines a decision unit as "the defined area or volume in question, that is, that area or volume about which we need to make a decision."

A total of 36 MI decision units were sampled between August 8 and September 21, 2007. Thirty subsamples were obtained within each decision unit to make up the MI sample. More information about the sampling program and target analytical suites is provided in Appendix E. The soil piles and MI sample locations are listed in Table E-01 and are shown in Figure E-8.

In accordance with MI sampling guidance (ADEC, 2007), triplicate MI samples were collected at approximately 10 percent of the MI decision units. The 95 percent upper confidence limit (95 UCL) values calculated for analytes detected in the triplicate MI samples were used to adjust the detected results for all other MI samples associated with that triplicate group. Triplicate samples were obtained at sample locations SP06-01, SP13-05, SPA, and SP27. Table E-01 indicates which MI decision unit samples are associated with each Soil Pile MI triplicate.

During the course of MI sampling in Soil Pile 06 (decision unit SP06-05), a high PID reading indicated the possible presence of contaminated soil. Soil from this portion of the pile was not incorporated into an MI sample. A discrete sample was collected at this location, as shown in Table E-01.

As with earlier samples collected from soil piles, the soil piles represented material from the FCS that, prior to excavation and removal, could have acted as primary or secondary sources of COIs, so the soil pile samples are considered part of the source characterization group, which is evaluated in Section 4. Detailed analytical results for the samples are presented in Appendix I, Table I1-4g.

The sample results for all MI decision unit samples for the soil piles were below the landfill criteria. The discrete soil sample result for SP06-05 contained 1,100 mg/kg of DRO, which exceeded the landfill criterion. Consequently, that portion of Soil Pile 06 was characterized and disposed of separately by the Fort Wainwright DRMO.

Several soil piles were moved following sampling. Discrete confirmation samples were collected from the surface soil beneath each former soil pile location. These samples were not used to characterize the soil piles for disposal but were incorporated in the overall nature and extent of contamination evaluation for surface soils at the FCS (see Section 5). Sample results are presented in Appendix I, Table I1-4g.

Sound Berm Characterization. The sound berm is an earthen mound that extends around the south and southeast portions of the FCS (Plate 1). The sound berm was constructed from soil and organic matter removed from the surface of the FCS during site-clearing activities. The objective of the sound berm sampling program was to determine whether these soils contained elevated concentrations of target analytes and might require further delineation to support risk assessment evaluations. The process used for the sound berm characterization involved comparing results of the MI decision unit samples to conservative levels for risk-based soil screening and background concentrations. If the concentrations of target analytes in an MI decision unit exceeded these criteria, a follow-up sampling program consisting of discrete surface soil samples would need to be conducted.

The sound berms were divided into nine decision units and an MI sample was collected from each decision unit. In accordance with MI sampling guidance, 30 subsamples were obtained within each decision unit to make up a single MI sample. Duplicate and triplicate MI samples were collected at decision unit 9 (DB09) from locations 5 feet north and 5 feet east of the original MI sample location. Table E-02 lists general sample information for the MI decision unit samples. More information about the sampling program is provided in Appendix E. The sound berm MI decision units and sample identification numbers are shown in Figure E-9. Detailed analytical results for the samples are presented in Appendix I, Table I1-4e.

Concentrations of benzo(a)pyrene in two MI decision units (DB04 and DB06) of the sound berm exceeded the screening level of 0.015 mg/kg. Therefore, additional discrete surface soil samples were needed from these decision units to support evaluation of possible risk associated with benzo(a)pyrene in surface soil during the human health risk assessment.

Drum and Debris Investigation and PCB Removal Activities. The primary objective of the 2007 drum and debris investigation was to characterize environmental waste, including material in buried drums and other excavated material, that could be potential sources of site contamination.

The 2007 drum and debris investigation focused on geophysical anomalies identified at Buildings 15, 17, 48, and 49, as determined by an EM geophysical survey (EM61) performed by CRREL in March 2007 (Figure E-10). The drum and debris investigation areas are shown in Figure E-11.

The PCB investigation focused on the Building 52 foundation area where PSE II sampling results indicated high levels (greater than 1 ppm) of PCBs in soil. Additional areas of investigation included the TSA east of the site and several other PCB hot spots (localized areas of contamination) across the FCS. The USACE contractor, Jacobs Engineering Group, performed the drum-and-debris investigation, which included excavation, field screening, and characterization of waste that was removed. CH2M HILL then performed confirmation sampling of the excavation floor and sidewalls of each excavation to evaluate possible residual levels of contamination in the underlying and surrounding soil.

The 2007 drum and debris and PCB removal activities are documented in Appendix D. Analytical results for waste characterization and soil samples obtained during the 2007 excavation and removal program are provided in Appendix I, Tables I1-4a through 1-4d (headings in the Appendix I tables indicate the evaluation group assignment for each sample).

Buildings 15 and 17 Excavation. The footprint of the Buildings 15 and 17 excavation is shown in Figure E-11a. The average excavation depth was approximately 8 feet, and the maximum depth was 15 feet, where groundwater was encountered. The deepest areas of the excavation corresponded to the strongest EM61 signature directly north of Building 15, where the largest amount of debris was removed.

One hundred and ninety drums were removed from the excavation, the majority of which were crushed and empty. Two drums contained residual amounts of a fuel-water mixture, and approximately 10 contained residual amounts of tar. More than 100 drums were in another high-density anomaly area immediately north of Building 15. Several small oil-burning furnaces and one large (approximately 30 feet long by 20 feet wide) oil-burning furnace were also located in this excavation. The largest furnace was removed from directly underneath the foundation of Building 15. The furnaces contained potential asbestos-containing material (ACM), which was removed, double-wrapped, and disposed of at the Fort Wainwright landfill. Other waste items removed from the Buildings 15 and 17 excavation included lead-acid batteries, charcoal (contained within gas masks), and degraded paint cans. Soil with potential lead contamination (collocated with lead-acid battery plates at various locations across the excavation), solvent contamination, and fuel contamination was also removed. Confirmation samples were collected from the floors and sidewalls of the excavations and analyzed for VOCs, SVOCs, TPH, pesticides, herbicides, PAHs, explosives, and metals, including lead (see Appendix I, Table I1-4d)

Approximately 800 munitions-related items were recovered from the Buildings 15 and 17 excavation. Of these, a small number of items were classified as DMM, and the rest were classified as MD. Following detonation at the Fort Wainwright Ammunition Storage Point by Fort Wainwright EOD personnel, items originally classified as DMM were reclassified as MD. This reclassification occurred because of the absence of explosive constituents within the items. These DMM items included M41 20-pound fragmentation bombs, 8-inch projectiles, and a 3.5-inch M29 practice rocket (live motor).

Building 48 Excavation. The excavation footprint for the Building 48 excavation is shown in Figure E-11b. Excavation limits were determined by metal debris, contamination, and underground utilities. Scrap metal debris and drums were encountered at less than 1 foot bgs and continued to a maximum depth of 8 feet. The average depth of excavation was 7 feet. Underground utilities, including electrical and communications service components, glycol, and water, were either removed or excavated around by hand, if necessary.

Items removed from the excavation included 159 drums, several small transformers, scrap metal, and lead-acid battery plates. Most drums were crushed and empty; however, some contained tar/asphalt residue, and one contained 20 gallons of a liquid that was characterized as degraded gasoline. The liquid was removed from this drum, and contaminated soil associated with it was removed from the excavation and stockpiled. Contaminated soil associated with lead-acid battery plates was also removed and stockpiled.

Munitions-related items were also encountered at Building 48, including one MK2 practice hand grenade and many other items of MD. None of the items contained explosive constituents, and all were disposed of as scrap. Before backfilling, a geophysical survey of the excavation was conducted. Several minor anomalies were observed and determined to be small scraps of metal, which were removed.

Building 49 Excavation. The 2007 Building 49 excavation is shown in Figure E-11c. Drums were encountered from 5.3 to 9 feet bgs, and 186 drums were removed from the excavation. The majority of these drums did not contain any material, had what appeared to be many manmade holes, and were crushed. Approximately 30 drums contained residual amounts of asphalt/tar material, and a smaller number of drums contained significant amounts of tar or degraded fuel. Several degraded 5-gallon paint cans were discovered adjacent to the sewer line. Small amounts of metal debris, rubber bladders, concrete, and burnt wood were also recovered from the excavation. No munitions-related items were encountered at Building 49. Investigation activities revealed that drums were located close to Building 49 and appeared to extend beneath the southwest corner of the building. Excavation also occurred around underground sewer and water utilities in the area. Excavations continued vertically and horizontally around areas with drums until field screening and visual and olfactory observations indicated that either a natural soil horizon or an uncontaminated area free of debris had been reached. CRREL performed a secondary geophysical survey before backfilling. Several minor anomalies were observed and determined to be small scraps of metal, which were removed.

PCB Investigations. PCB-contaminated soil was removed at the PCB EZ near Building 52 and the TSA in 2007 (Figure E-12). PCB hot spots just north of the EZ were also removed in 2007. The excavations removed PCB-contaminated soil until field screening confirmed that PCBs in the excavation bottom and side walls were below the 1-mg/kg ADEC Method 2 level for residential cleanup.

Excavation in the Building 52 area was separated into four sections (Figure E-12a). Field screening in the north, south, and east sections identified PCB contamination between 1 and 10 mg/kg, and the central area contained PCB contamination above 10 mg/kg. The final depth of the main excavation varied between 3 and 14 feet bgs.

Several items relating to power generation, historically associated with former FCS operations, were removed during the excavation, including copper wire, ceramic sections of transformers, and power poles.

Five additional areas of PCB contamination were identified outside of the main PCB investigation area—two immediately north of the EZ, one to the west of the main excavation, and two within the playground area (Figure E-12b). In the area immediately north of the EZ, two areas were excavated to a depth of 2 feet bgs. At the area west of the main PCB EZ excavation, field screening undertaken during the PSE II study indicated PCB contamination present at 5 feet bgs. Therefore, excavation centered on this location extended to a depth of 6 feet bgs, and because of clean field screening and confirmation results, the excavation did not extend farther than the original 10-foot by 10-foot grid. The excavation at one of the hot spots in the playground area extended to a depth of 2 feet bgs. A second excavation within the playground area had a maximum depth of 3 feet bgs.

Two areas in the TSA were excavated (Figure E-12c). The maximum depth of excavation in this area was 2 feet bgs.

Confirmation Samples. The objectives of confirmation sampling for the 2007 drum and debris removal activities were: (1) to evaluate the soil conditions at the bottoms and sidewalls of excavations following removal of buried drums and debris and PCB-contaminated soil at the excavations described above; and (2) to provide data for the overall soil characterization and risk assessment evaluations.

Table E-03 lists general sample information for the confirmation samples. Analytical results for all samples are presented in Appendix I, Table I1-4a through I1-4d (headings in the

Appendix I tables indicate the evaluation group assignment for each sample). Results for samples from areas and depths that were not excavated later are included in the nature and extent of contamination and risk assessment evaluations presented in Sections 6 and 7.

Buildings 15 and 17 Drum and Debris Investigation. The confirmation sample locations for the Buildings 15 and 17 investigation are shown in Figure E-11a.

Building 48 Drum and Debris Investigation. The confirmation sampling locations for the Building 48 excavation are shown in Figure E-11b. In general, confirmation samples were collected on a 50-foot by 50-foot grid or smaller interval in areas of suspected contamination.

In the excavation area north of the glycol line and closest to Building 48, there was a suspected solvent-affected area near sample location Building 48-12. (The glycol line was avoided during excavation.) In the area surrounding sample location Building 48-26, batteries and battery parts were removed. South of the glycol line, west of Building 35, paint drums were recovered in the vicinity of sample location Building 48-40.

Building 49 Drum and Debris Investigation. The confirmation sampling locations from the floor and walls of the Building 49 excavation are shown in Figure E-11c. In general, confirmation samples were collected on a 50-foot by 50-foot grid. However, in areas of suspected contamination, the sample density was increased according to the best professional judgment of the field team.

PCB Removal Confirmation Sampling. The objective of the confirmation sampling for the 2007 PCB removal was to evaluate the soil conditions at the bottoms and sidewalls of excavations following removal of PCB-contaminated soil within the PCB EZ and the TSA. The locations of the confirmation samples for the PCB removal are shown in Figures E-12a, E-12b, and E-12c.

Excavation for the Building 52 area was divided into four main sections, identified in Figure E-12a as 100, 200, 300, and 400; excavations occurred incrementally in each area until all sections were connected. CH2M HILL collected excavation screening samples within 10-foot by 10-foot grids along the floor and sidewalls of each excavation using Hach® test kits to evaluate possible residual levels of PCBs in underlying and surrounding soil. If the screening sample failed, the grid node was re-excavated vertically 1 foot or horizontally 5 feet, depending on the location of the failing sample. This process continued at the PCB EZ excavations until the screening sample passed, and then a confirmation sample was collected and sent to the project laboratory for analysis. At the TSA, after initial excavation, PCB confirmation samples were not screened; they were sent directly to the project laboratory for analysis. Confirmation samples from the PCB investigation excavations were analyzed only for PCBs.

Soil and Groundwater Characterizations. The objective of the soil and groundwater investigations was to characterize contaminant concentrations in soil and groundwater at the FCS in order to support the human health and ecological risk assessments.

During the 2007 field season, 63 soil borings were advanced, logged, and sampled. Figure E-13 shows the locations of the soil borings. Three soil samples were collected from each soil boring near the ground surface (4 feet bgs), in the vadose zone (4 to 10 feet bgs), and in the smear zone (11 to 13 feet bgs), for a total of 189 soil samples. Table E-04 lists general sample information for the samples collected from the borings. Boring logs and additional sample information are also provided in Appendix E. Analytical results for the soil samples are provided in Appendix I, Table I1-4e, I1-4f, and I1-4g.

Following the completion of the soil borings and collection of soil samples, 60 of the soil borings were completed as 20-foot-deep shallow monitoring wells (MW13 through MW65 and MW67 through MW76), and two soil borings (MW39 and MW40) were completed as deep monitoring wells. Figure E-14 shows the locations of all FCS monitoring wells installed through 2007. Well construction information is provided in Appendix E. Soil boring SB-66 was in advanced at a location on the northern boundary of the subdivision near two other borings completed as wells (MW-64 and MW-65) and it was determined that an additional well was not needed to characterize groundwater conditions in that area.

Monitoring well sampling took place from October 2 to 26, 2007. Samples were collected from all groundwater-monitoring wells by using EPA low-flow groundwater-sampling field procedures (CH2M HILL, 2007d, 2007e). Table E-05 lists general sample information for the fall 2007 groundwater samples. Analytical results for the groundwater samples are listed in Appendix I, Tables I2-1a and I2-1b (analytical results for groundwater are listed by well and date, rather than by investigation to facilitate evaluation of possible changes over time).

Fall 2007 Soil Gas Investigation

The objectives of the fall 2007 soil gas investigation were to characterize site soil gas and evaluate the potential for volatile contaminants to affect indoor and outdoor air.

On August 20 to 23, 2007, and October 3 to 6, 2007, a total of 110 semipermanent, subslab, soil gas probes were installed in the 55 buildings in the Taku Gardens family housing development. Two subslab probes were installed two per building, with one in each of the two garages. The soil gas probes were installed with a direct-push rig. The soil gas probes were vacuum leak tested and sampled from August 22 to 30, 2007, and from October 11 to 26, 2007, according to the procedures outlined in the Standard Operating Procedures (Appendix R). Subslab soil gas samples were collected 3 inches below the bottom of the slab floor. Appendix R also includes configurations and floor plans for each of the duplex model types from construction as-built drawings.

During September 5 to 11, 2007, a total of 53 semipermanent, vadose zone soil gas probes were installed at 5 feet bgs in open areas of the FCS. One soil gas probe in the PCB EZ, SG050, was destroyed by excavation equipment after it was sampled. Vadose zone soil gas sampling was conducted between September 7 and 29, 2007. A vacuum leak test was performed on the sampling assembly before each sampling, and a leak test with helium gas, helium gas enclosure, and helium detector was performed on 10 percent of the probes. None of the soil gas probes had measurable leaks detected. Each soil gas probe was purged before the soil gas sample collection.

FCS and non-FCS ambient air was sampled during the two sampling events. The onsite ambient air was collected adjacent to sample location ID SG047-L. The non-FCS ambient air sample was collected along the western FCS fence. The ambient air samples were collected at breathing height for a standing adult person.

The locations of the 2007 soil gas samples are shown in Figure E-15 and sample information is listed in Table E-06. Subslab and vadose zone soil gas port construction information and sampling records are included in Appendix E.

Six detected soil gas analytes were identified as possible vapor intrusion contaminants based on comparison to screening levels. Twenty-two additional analytes were undetected, but had method detection limits (MDL) that exceeded their respective screening levels. The MDLs for many of these analytes were elevated because of the unanticipated presence of high levels of Freon-related compounds in the soil gas. The Freon-related compounds might have been related to foam board and spray insulation construction of the housing development, and were not considered target analytes for the RI. Because of uncertainties about levels of detection and interferences encountered during the soil gas investigation, the soil gas data for the samples were not considered usable for the risk assessment and additional soil gas investigation was recommended. The soil gas data for samples obtained from the borings was considered usable for evaluation of potential VOC source areas. Sample listings and analytical results for the fall 2007 vadose zone subslab soil gas samples are provided in Appendix I, Tables I3-1 (vadose zone) and I3-2a through I3-2c (subslab soil gas); analytical results for subslab soil gas are listed by location and date, rather than by investigation to facilitate evaluation of possible changes over time.

Drainage Swale Sediment

The two main drainage swales for the FCS converge north-northwest of Building 1, and a combined swale runs in a north-northeast direction past the SAS building. Three discrete samples were collected from sediment in the combined drainage swale on September 21, 2007. The purpose of the drainage swale sampling was to determine whether COIs from the FCS had migrated beyond the FCS boundary via stormwater runoff. Sample locations are shown in Figure E-16. All three samples were collected from the upper 6 inches of sediment in the drainage swale and contained large amounts of roots and organic matter. A light rain fell 2 days before the sampling effort, but there was no standing water in the drainage swale at the time of sampling. The sediment samples were also considered to be soil samples and were used in the general assessment of soil conditions at the FCS. Sample information for the soil/sediment samples is included in Table E-07. Sample listings and analytical results for the soil/sediment samples, which are designated by the DSS prefix, are provided in Appendix I, Table I1-4e.

Hydrogeological Investigation

The objective of the hydrogeological investigation was to characterize the physical aspects of groundwater conditions at the FCS, including identification of groundwater flow direction and estimation of the capture zones for the Building 3559 water supply wells under different pumping regimes.

Groundwater Level Survey

Groundwater levels in most existing wells and all newly installed monitoring wells were measured on October 27, 2007. Supplemental data on water levels were also obtained from several wells on November 7, 2007. Groundwater level measurements and elevation data for the 2007 survey are presented in Appendix E. Figure 2-2 provides a contour map based on the data collected in October 2007.

Aquifer Pump Testing and Capture Zone Analysis. A modified pump test was performed at the Building 3559 supply well on November 2, 2007. The purpose of the test was to develop site-specific quantitative information about aquifer permeability on the FCS so as to update an existing groundwater flow model for Fort Wainwright and evaluate the potential for the operations of the water supply wells in Building 3559 to induce the migration of FCS groundwater contamination toward and into the production wells, thus compromising the quality of the FWA water supply.

Before the pump test, pressure sensor transducers were installed in monitoring wells MW39 (deep well), MW40 (deep well), and MW07 (AP-9482) and in well AP-7183 following the manufacturer's suggested installation and setup guidelines. Time-of-use meters were installed on Pump 1 and Pump 2 of the Building 3559 supply well. During the pump test, readings of the clear well level, total gallons flowing into the water plant, and gallons per day of effluent as shown on monitoring equipment in the water plant were recorded in 2-minute intervals and then 1-minute intervals when the clear well reached 9.15 feet, until the test was stopped.

After the test, the time-of-use meter information was downloaded, and 24 hours after the conclusion of the pump test, the transducer data and water levels from the four groundwater-monitoring wells were downloaded. The transducers were left for continued groundwater level monitoring at the FCS.

A historically used local-scale model of groundwater flow for the Fort Wainwright area was adapted and used to characterize both the physical properties of the aquifer in the vicinity of the FCS and the magnitude of the hydraulic stresses that would be imposed on the aquifer system by groundwater production. The finite element model was developed by using the MicroFEM package for groundwater flow modeling as described in Hemker and Nijsten (1996).

The groundwater flow model was rerun with inputs from the results from the 2007 RI aquifer testing to estimate the extent of the hydraulic capture zone generated by the long-term operation of the FWA water supply wells in Building 3559 during the upper range of demand (1,700 gpm). The capture zone generated at 1,000 gpm (the lower range of demand) was also estimated. The estimated maximum extents of the hydraulic capture zones predicted by the model for the supply wells are shown in Plate 1. Further details about the capture zone analysis, including sensitivity analyses conducted in 2010, are provided in Appendix B.

Ecological Risk Screening Evaluation. An ecological risk screening evaluation was conducted to identify possible threats posed to terrestrial and offsite aquatic wildlife by FCS contaminants. Analytical data for drainage swale sediment and groundwater samples from wells closest to the Chena River were considered in the risk assessment. The overall risks to wildlife were found to be low, as documented in Section 7. Given these findings, no further data needs that would require additional investigation during subsequent RI field activities were identified.

2008 RI Field Activities

RI field activities in 2008 were designed to build on and complete data sets collected during the 2007 RI activities and previous investigations. The investigative activities carried out in 2008 are described below. For soil:

- Confirmation screening to determine which portions of soil pile SP06 required disposal by the DRMO
- Collection of discrete soil samples at sound berm decision units DB04 and DB06 to obtain non-MI benzo(a)pyrene results for use in the human health risk assessment
- Removal of remaining PCB-contaminated soil at the Building 52 PCB excavations, followed by additional confirmation sampling
- Removal of remaining PCB-contaminated soil at the playground, followed by additional confirmation sampling
- Additional investigation of surface soil contaminated with DDT and benzo(a)pyrene north of Building 11
- Drum and debris investigations at Buildings 15/17, 22/24, and Subarea D
- EM61 drum and debris investigations in areas with readings exceeding 75 mV
- Additional surface soil sampling (0 to 2 feet bgs) as deemed necessary to obtain adequate coverage to complete the human health risk assessment, following completion of all soil removal and investigations of drums and debris

For groundwater, the existing monitoring well network appeared to provide adequate coverage to assess groundwater conditions at the FCS, with the following exceptions:

- The extents of the TCE and PCE contamination along the former slough channel and at depth in the aquifer were not established by the existing well network.
- The extent of 1,2,3-trichloropropane contamination in groundwater adjacent to the capture zones for the FWA water supply wells was not established by the existing well network.

The MDLs reported for many nondetect results in the groundwater data set were above the screening levels, making determinations about contamination extent and absence of other contaminants uncertain. Future groundwater sampling events would need to employ selective ion monitoring (SIM) or similar low-level analytical methods to achieve detection limits consistent with screening levels for certain key analytes (for example, PCE, TCE, and vinyl chloride).

For soil gas, additional rounds of subslab sampling using modified analytical methods to mitigate interfering effects of Freon in the samples.

The 2008 RI field activities also included continued investigation in areas of known or suspected buried debris. Table 2-5 provides an overview of the number and types of samples collected in and the analyses performed in 2008. The activities are summarized in the following subsections.

Soil Stockpile Characterization and Confirmation Sampling. Characterization of the soil stockpiles at the FCS took place primarily during the 2007 field season. During that time, most of the onsite soil stockpiles were sampled and characterized for disposal. These soil piles were then disposed of offsite as deemed appropriate based on sampling results. The soil piles remaining in 2008 were characterized as part of the 2008 field activities.

In 2008, five remaining soil stockpiles associated with FCS construction activities required disposal: three piles that had been staged at the DRMO during 2005 construction activities; one onsite pile along the fence just south of the PCB EZ that contained soil and organic debris, and one non-FCS pile near the corner of Alder Avenue and 9th Street, with contents of unknown origin. The DRMO stockpiles were known to contain petroleum constituents (east and west stockpiles) and pesticides (central stockpile) based on 2005 sampling results. The non-FCS stockpile had not been characterized. The objective of the 2008 soil pile sampling effort was to characterize the soils for possible treatment and disposal and, following removal of the soil piles, to determine whether contaminants in the piles had affected the underlying soils.

Confirmation samples were also collected from beneath the former locations of four soil stockpiles at the FCS: SP03 and SP06, which were removed in 2007, but for which MI sampling indicated the presence of fuel contamination; and SP01 and SP02, which were removed during 2008.

The soil stockpile and confirmation samples were analyzed for the target analyte groups listed in Table E-08. Sample locations are shown in Figure E-17. Analytical results for the stockpile samples and the confirmation samples are provided in Appendix I, Tables I1-5c and I1-5d.

Petroleum-Contaminated Soil Piles at the DRMO. The two petroleum-contaminated soil piles (the east and west stockpiles) that had been staged at the DRMO were thermally treated and transported offsite for disposal between September 19 and 22, 2008. The total volume of the two stockpiles was approximately 1,000 yd^3. Five confirmation samples were collected from the area that had been beneath the west stockpile, and three confirmation samples were collected from the area that had been beneath the east stockpile. These samples were analyzed for total petroleum hydrocarbons (DRO, RRO, and GRO), VOCs, pesticides, herbicides, and metals (Appendix I, Table I1-5d).

Pesticide-Contaminated Soil Pile at the DRMO. The third (middle) stockpile at the DRMO contained DDT-contaminated soils. According to the characterization samples collected during 2005, one result of 79 mg/kg was detected (greater than 10 times the screening level of 1.7 mg/kg), and the remaining samples contained lower concentrations. The 2008 field activities included resampling and segregation of 30 yd^3 of the more highly contaminated soil from the remainder of the soil pile, followed by confirmation sampling within the pile. Analytical results for the soil samples are provided in Appendix I, Table I1-5c.

The soil pile was segregated and removed between October 16 and 21, 2008, and confirmation samples were collected from the soils that had been beneath the soil stockpile. A total of 1,200 yd^3 was transported offsite for disposal as nonregulated pesticide-contaminated soil. The 30 yd^3 of soil containing the high concentrations of DDT was transported offsite for disposal as regulated pesticide-contaminated soil.

Offsite and Organic Stockpiles. The organic stockpile near the PCB EZ had not been previously characterized. Two samples were collected from the stockpile for waste characterization. Two samples were also collected from the area that had been beneath the stockpile and analyzed for explosives, metals, PAH, pesticides, SVOCs, DRO, GRO, RRO, and VOCs. The stockpile contained mixed organic debris, which was disposed of at the landfill. Figure E-17 shows the location of the organic stockpile confirmation samples. The offsite (i.e., non-FCS) stockpile also had not been previously characterized. Two soil characterization samples were collected from the stockpile on September 11, 2008. Two confirmation samples were collected from the area that had been beneath the stockpile and were analyzed for metals, herbicides, pesticides, PCBs, SVOC, DRO, RRO, GRO, and VOCs. The stockpile was removed and placed in Super Sacks® for offsite disposal on September 26, 2008.

Sample information for the offsite stockpile soil and the confirmation samples is presented in Appendix E (Tables E-15 and E-08). Analytical results for the offsite stockpile samples are presented in Appendix I (Table I1-5c). Analytical results for) confirmation samples collected after removal of the stockpiles are also presented in Appendix I (Table I1-5c).

SP03 and SP06 Confirmation Samples. As indicated in Section 4.1, the SP03 and SP06 stockpiles removed in 2007 had contained evidence of fuel contamination. However, no confirmation samples had been collected from the underlying surface soil after the piles were removed. The confirmation samples were collected on September 23, 2008, and were analyzed for DRO, RRO, and GRO, metals, and SVOCs. Sample locations are shown in Figure E-7. Analytical results for confirmation samples collected after removal of the stockpiles are presented in Appendix I (Table I1-5d).

Sound Berm Follow-up Sampling. Two of the MI samples collected from sound berm decision units DB04 and DB06 in 2007 contained benzo(a)pyrene concentrations in excess of the screening level. Because the potential risks associated with the benzo(a)pyrene needed to be evaluated and ADEC does not currently allow use of MI sample results in risk assessment, additional discrete soil samples needed to be collected from the two sound berm decision units. Ten surface soil samples (and one field duplicate) were collected from each decision unit. Samples were spaced evenly throughout each decision unit, and all samples were collected from the top of the sound berm (Figure E-18). The samples were analyzed for PAHs (Table E-09). Analytical results for the sound berm samples were used in the nature and extent of contamination and risk assessment evaluations and are provided in Appendix I, Table I1-5d.

Surface Soil Sampling. The objective for the surface soil sampling was to characterize surface soil (0 to 2 feet bgs) throughout the FCS to improve the areal and multichemical representation across the FCS, allowing for more comprehensive assessment of potential human health risks. A total of 78 samples were collected between October 7 and 11, 2008. Locations of the surface soil samples are shown in Figure E-19. The samples were analyzed for the full list of target analyte groups for the FCS, as indicated in Table E-10. Analytical results for the surface soil samples were used in the nature and extent of contamination and risk assessment evaluations and are provided in Appendix I, Table I1-5d.

Monitoring Well Installation and Subsurface Soil Sampling. Five additional monitoring wells were installed at the FCS to provide additional sample coverage in areas where possible groundwater contamination was identified during the fall 2007 groundwater sampling event. The following wells were installed between September 30 and October 4, 2008:

- MW77—a shallow well to provide additional characterization of TCE and PCE in groundwater along the northern FCS boundary
- MW78—a deep well to provide additional characterization of 1,2,3-trichloropropane in groundwater adjacent to the supply well capture zone
- MW79—a shallow well to provide additional characterization of 1,2,3-trichloropropane in groundwater adjacent to the supply well capture zone
- MW80—a deep well to delineate vertical extent of TCE and PCE in groundwater
- MW81—a shallow well to evaluate groundwater conditions in the PCB EZ where elevated concentration of PCB remained in subsurface soil

The new well locations are shown in Figure E-20. Shallow wells were installed with total depths approximately 5 feet below the water table, with 10-foot screens straddling the water line. The two deeper wells (MW78 and MW80) were screened from 23.0 to 33.0 feet bgs and 36.8 to 46.8 feet bgs, respectively. Soil boring logs and additional details about the well installations are included in Appendix E.

Surface and subsurface soil samples were collected for laboratory analysis from the soil borings used for well installation, as follows:

- 1 to 2 feet for surface soil samples
- 4 to 10 feet bgs, in the vadose zone at a location likely to contain contamination based on PID field screening results
- The depth interval directly above the groundwater table (smear zone), estimated at 11 to 14 feet bgs

Sample depths and target analytes for each soil sample are listed in Table E-11. Analytical results for the soil samples were used in the nature and extent of contamination and risk assessment evaluations and are provided in Appendix I, Table I1-5d.

Groundwater Sampling and Analysis. Two groundwater sampling events took place at the FCS during 2008: the spring event between May 14 and 21, 2008, which involved sampling at 28 previously installed wells selected by the Army for continued monitoring, and the fall event between October 3 and 9, 2008, which included the same 28 wells and the 5 newly installed wells. The Army selected wells for continued sampling based on review of monitoring well coverage relative to groundwater flow direction, FCS and water supply well capture boundaries, the locations of known and potential source areas, and analytical results from the monitoring wells. Sample information for each event and rationale for continued monitoring for individual wells are listed in Table E-12a (wells included in interim monitoring program) and Table E-12b (wells not included in the interim monitoring program). Well locations are shown in Figure E-20. The samples were analyzed for the full list of target analytical group, including low-level VOCs and PAHs using SIM (Table E-12a). Selected wells were also analyzed for explosives using Method SW821A, and wells in or near the PCB exclusion zone were also analyzed for PCBs. Analytical results for the groundwater samples were used in the nature and extent of contamination and risk assessment evaluations and are presented in Appendix I, Tables 2-1a through 2-1c.

Subslab and Indoor Air Sampling and Analysis. An examination of the results of the 2007 subslab soil gas sampling indicated that six analytes (1,2,4-trimethylbenzene, benzene, chloroform, tetrachloroethene, trichloroethene, and total xylenes) were detected in soil gas at concentrations above the screening levels in use at the time (EPA Region 6 preliminary remediation goals for indoor air multiplied by a factor of 10 to approximate attenuation between soil gas and indoor environments), and were considered to be of potential concern for vapor intrusion. In addition, MDL objectives were not met for 22 undetected analytes as a result of dilutions required by high levels of Freon-related compounds in the samples. Though the Freon-related compounds themselves were not targeted by the investigation, their presence at high levels interfered with the analysis and required the samples to be diluted, which, in turn, raised the detection limit for other analytes. The levels of detection and interferences encountered during the soil gas investigation led to uncertainty about the presence or absence of some analytes. Two sampling events were conducted during 2008 to further investigate the attenuation of detected compounds from subslab to indoor air and to attempt to meet MDL objectives for the human health risk assessment.

Fall 2008. The fall 2008 soil gas investigation included collection of indoor air and subslab soil gas samples from ten residences considered to provide representative sitewide coverage and collection of one outdoor ambient air sample to represent background conditions. The indoor air and subslab soil gas sample pairings were largely exploratory in nature and intended to demonstrate whether the interferences of Freon compounds could be overcome.

TO-15 test methods for air were modified to include use of the mass spectrometer in both low-level scan and SIM modes to achieve the reporting limit objective and overcome possible Freon-related issues.

The subslab sampling points installed in 2007 in the garages of each Taku Gardens housing unit were used for the October 2008 subslab sampling. Subslab samples were collected over an approximate duration of 30 minutes in accordance with CH2M HILL’s standard operation procedure (SOP) (CH2M HILL, 2008e). Subslab sampling points were leak tested by using a helium leak check procedure before sampling, and sample points that failed the leak check were resealed and re-checked before sample collection.

Indoor air and outdoor ambient air samples were collected over a duration of 24 hours in accordance with CH2M HILL’s SOP (CH2M HILL, 2008e). Indoor air samples were collected from breathing level height at the same housing unit from which the subslab samples were collected to examine the attenuation factor from soil gas to indoor air. During this event, temperatures inside the housing units were intended to be adjusted to approximately 68°F to simulate typical living conditions; however, the heating units were not adjusted before sampling, and temperatures were generally much lower, around 47°F to 50°F.

The fall 2008 soil gas and indoor-air-sampling locations are shown in Figure E-21 and listed in Table E-13. Analytical results for the soil gas samples are presented in Appendix I, Tables I3-2a through 3-2c and were used in assessment of attenuation factors and are presented in Appendix N.

December 2008. On the basis of the success of the October 2008 sampling in reducing MDLs and providing indoor ambient/subslab results comparisons, an additional sampling event was conducted in December 2008 at all living units. The subslab sampling points installed in 2007 in the garages of each housing unit were used for the December 2008 subslab sampling event. Samples were collected from installed probes at all 55 completed units (one in each garage or two for each building).

In addition, ambient indoor air samples were collected again from the same 10 units where the fall 2008 sampling event occurred to provide additional subslab/indoor air comparisons with indoor air temperatures adjusted to reflect normal living conditions. The temperatures of the units were documented to be generally around 68°F with ventilation systems running at the time of sampling.

Sample collection procedures for December 2008 were the same as those used in October 2008, with the exception of the addition of ambient air sampling on consecutive days. Instead of a single ambient air sample, the December event included three samples collected from each of two outdoor sampling locations (one at the east fence and one at the west fence). These samples were collected during three consecutive 24-hour periods.

A total of 139 air samples were collected during the December 2008 sample event, as shown in Table E-13. The sample locations are shown in Figure E-1. The samples were analyzed for VOCs by using the same analytical methods as for the fall 2008 samples. Analytical results for the soil gas samples were used in the nature and extent of contamination and risk assessment evaluations and are provided in Appendix I, , Tables I3-2a through 3-2c.

Drum and Debris Investigation and Contaminated Soil Investigation Activities. The primary objective of the 2008 drum and debris investigation was to characterize environmental waste, including material emanating from and contained in drums, in the soil, and in other excavated materials, that could be potential sources of site contamination. As with the 2007 excavation activities, the drum and debris investigations focused on geophysical anomalies identified by the EM61 geophysical survey performed by CRREL in March 2007 and determined by professional judgment to represent accumulations of buried metal debris. In addition to continued excavation at anomalies identified at Buildings 15 and 17, the 2008 investigation included the excavations at large anomalies near Buildings 22 and 24 and in the southeastern portion of the FCS (former Subarea D), at several buildings where anomalies exceeding 75 millivolts (mV) were identified, and as a quality control check, at several less-than-75-mV anomalies. Figure E-22 shows the drum and debris excavation boundaries. Confirmation sample information is included in Table E-14, and individual sample locations (generally collected every 50 linear feet) are shown in larger-scale figures included for each excavation or excavation area (discussed below).

The contaminated soil investigation activities focused on removing residual PCB-contaminated soils in the vicinity of Building 52 and former Subarea E, and on investigating areas identified during the PRSE as containing elevated concentrations of target analytes (greater than 10 times the screening level). Jacobs excavated, conducted field screening of the soil removed from the excavations, characterized any waste that was removed, and collected confirmation samples from the floors and sidewalls of each excavation. Waste sample information is included in Table E-15. Confirmation sample information for each excavation for the contaminated soil investigation is provided in

Table E-14. Figure E-23 shows the location of PCB-targeted investigation excavations, and Figure E-24 shows the location of POL and DDT contaminant-targeted investigation excavations. Larger-scale figures (discussed below) show sample locations for POL and DDT excavations.

More information about the drum and debris investigations and contaminated soil investigation is provided in Appendix D. Analytical results for waste samples and confirmation samples are presented in Appendix I, Tables I1-5a through I1-5c.

Buildings 15 and 17 Excavation. The 2007 EM61 geophysical survey indicated a large area of anomalies north of Buildings 15 and 17. The investigation at Buildings 15 and 17 occurred during two field seasons, beginning on October 6, 2007, and ending on August 12, 2008. This subsection focuses on activities and sampling conducted in 2008.

The excavations at Buildings 15 and 17 included one main excavation and several smaller test pits that were installed to ascertain the lateral extent of the debris. The footprints of the excavations and confirmation sample locations are shown in Figure E-22a. The average depth was 8 feet bgs, and the maximum depth was 15 feet bgs, where groundwater was encountered. The deepest areas of the excavation corresponded to the strongest EM61 signature, such as the area directly north of Building 5. Materials removed included drums, lead-acid battery plates, and oil-burning furnaces. More than 200 yd^3 of contaminated soil was removed from the Buildings 15 and 17 excavation. This volume includes 210 yd^3 of petroleum-contaminated soil, 8 yd^3 of solvent-contaminated soil, and 16 yd^3 of lead-contaminated soil.

Buildings 22 and 24 Excavation. The 2007 EM61 geophysical survey identified a number of large anomalies in the area between Buildings 22 and 24 in the portion of the FCS formerly occupied by the Salvage Yard. The total footprint of the Buildings 22 and 24 excavation and the locations of confirmation sample locations are shown in Figure E-22b. The average depth of the excavation was approximately 8 feet bgs, and the maximum depth of excavation was approximately 12 feet bgs in areas with the strongest EM61 signatures.

Drums, several large oil-burning furnaces, one transformer, lead-acid batteries, paint cans, and various other items of metallic debris were removed from the Buildings 22 and 24 excavation. All drums except one were crushed and empty. The content of the single uncrushed drum was an oily mixture. Other materials removed from the excavation included gas cylinders, one fire extinguisher, one hydraulic cylinder containing hydraulic oil, paint cans, one transformer, and a crushed drum coated in oil. More than 1,500 munitions-related items were recovered from the Buildings 22 and 24 excavation, none of which were classified as DMM.

Southeast Area Excavation. The 2007 EM61 geophysical survey identified several large anomalies in the southeast portion of the FCS (former Subarea D). The total footprint of excavation is shown in Figure E-22c. The average depth of excavation ranged between 2 and 3 feet bgs, and the maximum depth was approximately 4 feet in areas with the strongest EM61 signatures.

More than 400 drums were removed from the former Subarea D excavation, most of which were crushed and empty, or the interior was coated with a layer of residual tar. Two drums contained an oily mixture. Two yd^3 of contaminated soil associated with paint cans were also removed.

Geophysical Anomalies Greater Than 75 mV. Geophysical evidence and results from the 2007 investigation suggested that anomalies with an EM61 result of 75 mV and above represent possible buried drums, munitions-related items, or other items of concern. Anomalies below 75 mV were considered to represent smaller items rather than large masses of metal debris (Jacobs, 2008b). In 2008, six EM61 anomalies in excess of 75 mV were evaluated and investigated. These areas were believed to represent significant potential for hazardous materials or potential items of concern, based on the strength and area of their signals, proximity to known areas of metallic debris, and comparison with historical maps and photographs. Anomalies above 75 mV that were known to be associated with building foundations and utilities were not investigated.

One location identified by the 2007 investigation as an area to be targeted for excavation (based on geophysical EM61 results greater than 75 mV), southwest of Building 39, was later determined to have high concentrations of surface debris and was not excavated. The surface debris was later removed and the area was resurveyed to confirm that the cause of the EM61 survey results had been removed (Belway, 2009).

Figure E-22 shows the excavation boundaries for all 2008 locations. Confirmation samples were collected from the floors and sidewalls of the EM61 anomaly investigation excavations, as indicated in Table E-14 and shown in Figure E-22d.

Building 1. Three anomalies were investigated at Building 1. The first excavation began in the center of Building 1, extended to the north approximately 20 feet, then turned west and ran to the end of the building. The second excavation was approximately 15 feet to the north and measured 16 feet by 8 feet. The third excavation was on the north side of the drainage ditch and measured approximately 46 feet by 40 feet. All excavations proceeded until the sidewalls and excavation floor were free of major metal debris. The excavations associated with Building 1 had an average depth of 4 feet. Excavation limits were determined by metal debris, proximity to Building 1, and the avoidance of underground utilities. Scrap metal debris was generally encountered at depths between 1 and 4 feet bgs, with no scrap metal encountered below 4 feet bgs.

Materials removed from the Building 1 excavations included one empty drum, less than 1 yd^3 of scrap metal debris, and soil mixed with concrete and rebar.

Building 11. The Building 11 anomaly excavation was mainly within the former east-west drainage ditch north of Building 11; a secondary excavation to remove DDT-contaminated soil occurred to the south. Excavation limits for the anomaly investigation were determined by metal debris. Scrap metal debris and drums were encountered at depths generally between 2 and 6 feet bgs, with no encounters below 6 feet bgs. At the time of completion, the excavation had an average depth of 6 feet.

Materials removed from the Building 12 excavation included empty drums, scrap metal debris, and soil that appeared to have been burned. The drums had interiors coated with tar.

Building 12. Scrap metal debris and drums were generally encountered between depths of 2 and 7 feet bgs, with no encounters below 7 feet bgs at the Building 12 anomaly. The excavation proceeded to the south, east, and west from Building 12 until the sidewalls and excavation floor were free of major metal debris. The excavation at the time of completion had an average depth of 7 feet. Excavation limits were determined by metal debris, proximity to Building 12, and the avoidance of underground utilities. Underground utilities, including electrical (de-energized), sewer, and water services, were excavated around. Once the area surrounding the utility lines was cleared of metal, the trenches were backfilled.

Materials removed from the Building 12 excavation included several drums (empty), scrap metal debris, lead battery plates, lead-contaminated soil, and creosote-soaked timbers and soil. Lead battery plates and the surrounding soil were placed in one 90-gallon overpack, sampled, and removed. Creosote-coated lumber and soil was excavated and placed in the landfill. Clean soil and scrap metal were separated, evaluated for munitions-related items, and moved to soil stockpiles and the scrap metal stockpile, respectively.

Building 26. The excavation at the Building 26 anomaly formed an "L" shape around the southeast corner of Building 26 and proceeded until the sidewalls and floor were free of major metal debris. The excavation at Building 26 had an average depth of 6 feet. Excavation limits were determined by metal debris, proximity to Building 26, and the avoidance of underground utilities. Scrap metal debris was encountered at depths generally between 1 and 6 feet bgs, with no encounters below 6 feet bgs.

Materials removed from the Building 26 excavation included one empty drum, airplane engine parts, miscellaneous scrap metal debris, and more than 400 yd^3 of burned soil mixed with small pieces of metal debris.

Buildings 31 and 28. Four small excavations were conducted in the vicinity of Buildings 28 and 31 (one each on the west and south sides of Building 28 and two on the east side of Building 31). Scrap metal debris was generally encountered between 1 and 6 feet bgs, with no encounters below 6 feet bgs. Excavation limits were determined by the presence of metal debris, munitions-related items, proximity to buildings, and PID readings. The excavations at Buildings 31 and 28 had an average depth of 6 feet.

Materials removed from the Building 31 and 28 excavations included one 75-mm RR cartridge case, several 3.5-inch M29 practice rockets, 60 yd^3 of fuel-contaminated soil, and miscellaneous scrap metal debris. All munitions-related items and contaminated soil were taken from the southern excavation at Building 31.

Building 16. Two small, shallow excavations were conducted at Building 16, with limits determined by the presence or absence of metal debris and a utility pole between the two excavations. Small amounts of scrap metal debris were generally encountered at depths between 0 and 2 feet bgs. Excavations proceeded until the sidewalls and floor were free of major metal debris, and no metal debris was encountered below 2 feet bgs. The excavation at Building 16 had an average depth of 2 feet.

Geophysical Anomalies Less than 75 mV. Ten percent of the anomalies with EM61 results below 75 mV were investigated to confirm the assumption that only strong (greater than 75 mV) anomalies represented areas where significant volume of metal debris and possible hazardous materials, wastes, and munitions-related items were buried and contamination might be present (Jacobs, 2008). The weaker signal anomalies at Buildings 2, 9, 13, 19, 29, 35, 38, 42, and 43 were investigated, and the sources of the anomalies were found to be utilities or minor amounts of metallic surface debris. No sources of potential contamination or visible or olfactory signs of contamination were observed within any of the excavations.

PCB-Contaminated Soil Removal. In addition to 50 yd^3 of additional soil removal at Building 52, six small zones of PCB-contaminated soil identified in and near the PCB EZ (former Subarea E) during 2008 data evaluation activities were also excavated. These additional locations are shown in Figure E-23 and described below:

- Two playground area excavations west of the Building 50 footprint, each 2 feet deep (including sample locations starting with "EXPLG")
- Two areas formerly beneath the west and north stockpiles of 2 feet bgs (including sample locations starting with "EX05" and "EXN02," respectively)
- Two areas where the main PCB excavation (400 section) was expanded to the west and north (sample locations starting with "EX52")

As with other PCB removal activities at the FCS, field screening was used to confirm that PCBs in the excavation bottom and side walls were below the 1-mg/kg screening level, then samples were collected for laboratory analysis. Sample information is provided in Table E-14 and analytical results for the confirmation samples are presented in Appendix I, Table I1-5c.

DDT-Contaminated Soil Removal. In April 2008, CH2M HILL conducted a screening evaluation of all pre-RI data and the results of the 2007 RI sampling activities and identified a surface soil sample location where the DDT concentration exceeded its screening level by more than 10 times. Excavation activities at the DDT contaminated area north of Building 11 were conducted on September 17, 2008. A 10-foot by 10-foot area centered on the exceedance location was excavated to a depth of 2 feet. DDT-contaminated soil was excavated and stored in Super Sacks® for disposal. Confirmation samples were collected from the floor and sidewalls of the excavation (Table E-14). The boundaries of the excavation and corresponding soil sample locations are depicted in Figure E-24a and analytical results are presented in Appendix I, Table I1-5a.

Petroleum-Contaminated Soil Removal. During construction of the housing units, stained soil associated with small heating-oil spills was observed in front of approximately 40 units. Because the locations of the observed spills were not surveyed, visual inspections were used during the 2008 field season to identify and remove stained soil. Petroleum-contaminated soil removal activities were performed at Buildings 9, 40, and 45, as follows:

- Building 9—3 yd^3 were removed from an area measuring approximately 6 feet by 10 feet and a depth of 1 foot.
- Building 40—around 60 yd^3 were removed from an area approximately 12 feet by 14 feet with an average depth of 7.5 feet.
- Building 45—3 yd^3 were removed from an area approximately 8 feet by 7 feet with an average depth of 1 foot.

Excavation locations are shown in Figure E-24b2. The boundaries of the excavation limits were determined by PID readings, and five excavation confirmation samples were collected (one from each sidewall and one from the excavation floor) from each excavation. The samples were analyzed for DRO and RRO (Table E-14). Analytical results are presented in Appendix I, Tables I1-5a (Building 9) and I1-5b (Buildings 40 and 45).

2009 RI Field Activities

2009 RI field activities were designed to build on and complete data sets collected during the 2008 RI activities and previous investigations. The investigative activities carried out in 2009 are described below:

- EM61 geophysical survey
- Drum and debris investigations at Buildings 11, 15/17, 35, and 49
- A fuel spill investigation at Building 9
- Sound berm sampling
- PCB investigations beneath former foundations in Subarea E
- Spring and fall groundwater-monitoring events
- Delineation of TCE and petroleum in groundwater in northern portion of site
- Delineation of 1,2,3-TCP in capture zone
- March 2009 subslab soil gas, indoor air, and outdoor air sampling for VOCs and radon
- August 2009 subslab soil gas, indoor air, and outdoor air sampling for VOCs and radon
- Foundation demolition and disposal in Subarea E
- Surface soil sampling (continuation of 2008 surface soil investigation)

Table 2-6 lists the number and types of samples collected and the analyses performed in 2009.

2009 Geophysical Survey. An EM61 geophysical survey was conducted by ERT after the conclusion of the 2008 investigation season to determine if the anomalies that had been the targets of the 2008 investigations had been successfully delineated. The survey took place primarily during September 2008 (Building 1, 12, 16, 22/24, 26, 31, 35, 48, 49 and the southeast area), and was completed during February of 2009 (Bldg 11 and 15/17) (Figure E-25). The survey indicated that most of the anomalous materials had been removed, but a few areas required additional investigation. These included the Building 11 and Building 15/17 areas, which were subsequently investigated during the 2009 field season.

Drum and Debris Investigations. The 2009 ERT EM61 survey indicated that geophysical anomalies indicative of buried metal remained in several portions of the FCS. In addition, the 2007 geophysical and excavation investigations had indicated that debris extended beneath the southeast corner of Building 49. Follow-up drum and debris investigations were continued in the vicinity of Buildings 11, 15/17, 35, and 49 and confirmation samples were collected from the floors and walls of the resulting excavations. An overview of the 2009 drum and debris investigation area is shown in Figure E-26, confirmation sample information is included in Table E-16, and individual sample locations (generally collected every 50 linear feet) are shown in larger-scale figures included for each excavation or excavation area (discussed below). Waste sample information for soil samples collected from excavated material is included in Table E-17.

More information about the drum and debris investigations and contaminated soil investigation is provided in Appendix D. Confirmation and waste samples are listed in

Tables E-17 and E-18, respectively, and analytical results for waste and confirmation samples are presented by location in Appendix I, Table I1-6a and I1-6b.

Building 11 Investigation. The 2009 EM61 geophysical investigation indicated that the excavation activities conducted on the north side of Building 11 in August of 2008 had not reached the limits of buried debris in this area. The investigation area was within Subarea A, and as a result, work was conducted in accordance with the Explosives Safety Plan (USAED, 2008). The footprint of the investigation area at Building 11 was approximately 10,575ft^2, with depths ranging from 2 to 6 feet bgs. Materials removed from the excavation included six crushed and empty drums, two drums with tar residue, and small pieces of metal debris. Confirmation samples collected from the investigation area are shown in Figure E-26a and analytical results for the samples are provided in Appendix I, Table I1-6a.

Building 15/17 Investigation. The 2009 EM61 survey identified three additional investigation areas at Building 15/17. The investigation area was within Subarea A, and as a result, work was conducted in accordance with the Explosives Safety Plan (USAED, 2008). A monitoring well located in the area (MW07) was decommissioned prior to the investigation.

The 2009 Building 15/17 investigation extended the 2008 investigation area in two areas to the north and northeast, and also included additional investigation at depth within the 2008 excavation boundaries. The total footprint of investigation area totaled 22,050 square feet (ft^2) and extended to depths of up to 15 feet. Recovered material included scrap metal debris. Confirmation samples collected from the excavation are shown in Figure E-26b and analytical results for the samples are provided in Appendix I, Table I1-6a.

Building 35 Investigation. The 2009 geophysical survey of the backfilled Building 35 excavation showed anomalies that indicated that some metal debris remained within the backfilled area. To confirm that all large metal debris had been removed from the anomalies, three test pits (TP01 through TP03) were dug within the area of the original Building 35 excavation.

All three test pits were approximately 12 feet long by 12 feet wide and approximately 8 feet deep. No large pieces of metal debris were found in the test pits. The EM61 hot spots appeared to have been caused by small pieces of metal debris mixed in with the fill material. Approximately two 5-gallon buckets of small scrap metal debris and barbed wire, and a small amount of dried paint chips were recovered from the fill removed from the test pits. Because no evidence of contamination was found in the test pits, no confirmation samples were collected.

Building 49 Investigation. The 2007 investigation at Building 49 indicated that drums and debris extended beneath the building foundation. In 2009, efforts were undertaken to remove the remaining debris from beneath the building. In preparation, an engineering design was developed by a licensed structural engineer for building support, excavation and backfill efforts. Precautions were taken to protect the structure and local utilities, including supporting the western garage foundation with seven permanent helical pier supports and three temporary I-beams and constructing the entrance ramp to avoid the water line near the south side of the building.

Before the excavation could be advanced beneath the garage foundation, the clean backfill from the previous excavation activity was removed to a depth of 13 feet and stockpiled for reuse in the final backfill operations. The investigation then continued vertically and horizontally until field screening and visual and olfactory observations indicated that either a natural soil horizon or an uncontaminated area had been reached. Geophysical scanning was not conducted because the building materials would have interfered with the identification of unwanted debris. Drums were encountered between 7 and 11 feet bgs and extended 15 feet beneath the garage foundation. Materials removed from the excavation included 42 crushed and empty drums, three drums containing water with a sheen, and 3 yd^3 of grease-affected soil. Confirmation samples collected from the excavation are shown in Figure E-326c and analytical results for the samples are provided in Appendix I, Table I1-6a.

Building 9 Fuel Spill Investigation. In July of 2009 a fuel odor and elevated PID readings were encountered during grading activities north of Buildings 9 and 11. This area coincided with the location where a pipe had been removed in 2008. Eleven test pits, each approximately 2 feet wide by 3 feet long by 3 feet deep were excavated at distances between 10 and 40 feet from the pipe, which was believed to be the source of contamination. Based on observations from these test pits, it was determined that the petroleum contamination extended approximately 40 feet northwest of the source.

After the rough extent of the contamination had been delineated, excavation activities commenced on August 4, 2009. The extent of the excavation was guided by PID readings and proximity to the SAS playground fence. Soil with readings above 20 ppm was removed and transported to waste stockpiles for future disposal. The final excavation was approximately 109 long by 45 feet wide. The eastern half of the excavation was approximately 6 feet deep (where PID readings were below 20 ppm), and the western half was 15 feet deep (where groundwater was encountered.) The excavation was terminated about 10 feet east of the SAS playground fence. Although stained soil was present in the sidewall of the excavation at this location, the concentration of DRO in the sample collected from the sidewall was below the ADEC Method 2 cleanup level. Materials removed from the excavation included approximately 920 yd^3 of fuel-contaminated soil and a variety of abandoned pipes, including 2-inch and 4-inch horizontal steel sewer pipes, a horizontal 4-inch water pipe, and an additional vertical 4-inch steel pipe. The vertical pipe was excavated to 12 feet bgs but could not be removed and was broken off and buried. Confirmation samples collected from the excavation are shown in Figure E-26d and analytical results for the samples are provided in Appendix I, Table I1-6a.

Sound Berm Sampling. In response to ADEC concerns that Decision Units 04 and 06 of the sound berm had not been adequately characterized by previous discrete soil sampling in 2008, these units were resampled in 2009. In accordance with "Taku Gardens Sound Berm Additional Sampling Locations" (USAED, 2009a), 10 discrete samples were collected at random locations along the side of the berm within each decision unit. The surface soil samples were analyzed for PAHs because only benzo(a)pyrene had been previously detected in samples from these units. Sound berm sample information is listed in Table E-18. Sample locations are shown in Figure E-27 and analytical results for the samples are provided in Appendix I, Table I1-6c.

Foundation Demolition and Disposal in Subarea E—PCB. Previous work conducted in Subarea E included the investigation and excavation of PCB-contaminated soils only around the foundations, but not beneath them. During the 2009 field season, work was conducted to remove nine building foundations within Subarea E and to determine whether PCB-contaminated soil was present beneath any of the foundations. This would prepare the area for future construction and identify potential contamination within the footprint of each building. Demolition and removal of foundations and associated materials and sampling activities were performed in accordance with the "2009 Taku Gardens PCB Area Foundation Demolition Technical Memorandum" (USAED, 2009b).

Approximately 1,526 yd^3 of concrete with rebar and 230 yd^3 of blueboard insulation were removed from the nine demolished foundations. Ten soil samples were then collected, within the former footprint from each location. The soil samples were obtained by excavating test pits until native material was located beneath the aggregate fill. The depth of the test pits ranged between 2 and 10 feet, depending on the thickness of the aggregate fill. All samples were analyzed for PCBs and one sample from each former foundation area was also analyzed for metals, PAHs, VOCs, SVOCs, pesticides, DRO, GRO, and RRO. Sample information is presented in Table E-19. Sample locations are shown in Figure E-28 and analytical results for the samples are provided in Appendix I, Table I1-6b.

Groundwater Monitoring. Two groundwater sampling events were conducted in 2009 to provide additional groundwater data in support of the RI. These included a spring event conducted between May 26 and June 5, and a fall event conducted between September 19 and 23. The wells selected by the Army for continued monitoring for the spring 2008 event (i.e., wells that had been determined to provide adequate site coverage) were again sampled during the two 2009 events, and wells installed as part of 2008 investigations were also sampled. Thirty-four wells were sampled during each event. A separate sampling event in November 2009 was required to obtain samples from the wells installed north and east of the FCS since these wells were installed after the fall 2009 monitoring event. Sample information for each event and rationale for continued monitoring for individual wells are listed in Table E-20. Well locations are shown in Figure E-29 and analytical results for the sampling events are provided in Appendix I, Tables I2-1a through I2-1c.

Delineation of Northern Groundwater Contamination. Groundwater samples collected from several wells along the northern boundary of the FCS in 2007 and 2008 contained elevated concentrations of TCE and DRO. As a result, 2009 field activities included additional investigations north of the FCS to delineate the extent of groundwater contamination. Work was conducted according to the technical memorandum "Taku Gardens: Delineation of the Northern Groundwater Plumes" (USAED, 2009a).

On August 2, 2009, Jacobs began installing 13 soil borings north of the site, as shown in Figure E-30. Groundwater grab samples were recovered immediately following drilling using the SP-16 direct-push sampling method. Two soil samples were collected from each boring. The soil and groundwater samples were analyzed by AK102, SW8260, and for low-level VOCs using 8260SIM. Following analysis of the results from the first 13 soil borings, on August 29, 2009, four additional soil borings (SB14 through SB17) were advanced, and soil samples and groundwater grab samples were collected to further delineate the plume. The wells were sampled on November 7, 2009, and analyzed for AK102, SW8260, and low-level VOCs. The locations of the borings and wells installed during the northern plume delineation are shown in Figure E-30, sample information is listed in Table E-21, and analytical results for the soil and groundwater samples are provided in Appendix I, Tables I1-6c and I2-1c.

Delineation of Eastern Groundwater Contamination. Concentrations of 1,2,3-trichloropropane were detected in several wells along the eastern boundary of the FCS in close proximity to the 1,700-gpm capture zone that was conservatively estimated for the FWA drinking water supply wells (see Section 2.1.5). Passive soil gas and groundwater sampling were conducted in late 2009 along the eastern boundary of the FCS to determine the source and extent of the 1,2,3-trichloropropane plume in this area. Work was conducted in accordance with the technical memorandum "Taku Gardens: Investigation of the 1,2,3-TCP Plume" (USAED, 2009).

On October 20, 2009, 67 Gore™ passive soil gas sampling modules were installed along three transects (two longer transects oriented mostly north–south and a third, shorter transect, oriented primarily east–west). The modules were left in place for an 8-day exposure period and recovered on October 28, 2009. The modules were then submitted to the laboratory for analysis, and all results were returned as nondetects, which suggests that the extent of 1,2,3-trichloropropane was limited.

Six monitoring wells (MW85 through MW90) were installed east of the FCS between October 30 and November 2, 2009. The wells were positioned to delineate the extent of 1,2,3-trichloropropane in groundwater and to provide early warning of possible movement of 1,2,3-trichloropropane toward the FWA water supply. One subsurface soil sample was collected from each well boring and analyzed for PAHs, VOCs, and low-level VOCs. After development, the new wells were sampled between November 7 and 9, 2009, and analyzed for PAHs, VOCs, and low-level VOCs. The locations of the borings and wells installed during the 1,2,3-trichloropropane investigation are shown in Figure E-31, sample information is presented in Table E-22, and analytical results for the samples are provided in Appendix I, Tables I1-6d and I2-1c.

Subslab and Indoor Air Sampling and Analysis. Additional subslab soil gas and indoor air investigation activities were carried out in March and August 2009 as described in the following subsections.

March 2009 Subslab Soil Gas and Indoor Air Sampling. The objectives of the additional soil gas and indoor air sampling conducted in March 2009 were: (1) to confirm the presence or absence of 1,2-dibromo-3-chloropropane in Building 13, where it had been reportedly detected during the October 2008 air sampling; and (2) to collect indoor air and subslab soil gas sample pairs from five units for radon analysis to be used in determining a site-specific attenuation factor for vapor intrusion. Realistic living conditions (temperature and ventilation) were established within the living units sampled. The locations of the 2009 subslab soil gas and indoor air sample locations are shown in Figure E-32.

Soil gas and indoor air samples for examining the presence or absence of 1,2-dibromo-3-chloropropane at Building 13 were collected from Units 13L and 13R on March 9 and 10, 2009. For each of the 13L primary samples, duplicates of both the indoor air and subslab samples were also collected. Primary and duplicate samples were submitted to Air Toxics Ltd. for 1,2-dibromo-3-chloropropane analysis by the modified TO-15 method. In addition, a split of each primary subslab sample was collected and submitted to a second laboratory, Columbia Analytical Services, for 1,2-dibromo-3-chloropropane analysis to provide additional quality assurance and control. 1,2-dibromo-3-chloropropane was not detected in any of the samples. Consequently, the suspect December 2008 result for 1,2-dibromo-3-chloropropane was not considered usable and was not included in the nature and extent evaluation or in the risk assessment.

Five soil gas and indoor air sample pairs were collected for radon at Units 42L, 2L, 34L, 25L, and 63L for use in determining a site-specific attenuation factor for soil gas intrusion. Units were selected for radon sampling according to the following ordered rationale:

1. Each of these was among the 10 previously sampled for paired subslab soil gas and indoor air sampling of VOCs in October and December 2008 so that direct comparison of VOC- and radon-derived attenuation factors for the same unit could be made.
2. The 10 units sampled previously were ranked by highest VOC screening level exceedances observed from the December 2008 sampling event.
3. From the ranked list of VOC screening level exceedances, units were chosen ensuring that a unit representing each floor plan was sampled.

For background purposes, two outdoor ambient air samples were collected, one each at the east and west fences at the approximate locations where background ambient air samples were collected in 2008. The radon samples were collected within new, clean Tedlar bags and were filled by using a negative-pressure sampling chamber apparatus. Sample information is presented in Table E-23, analytical results are provided in Appendix I, Tables I3-2a through I3-2c (target analytes in soil gas), and Appendix N (radon in soil gas and indoor air and target analytes in indoor air) and discussed in Sections 5 and 7.

August 2009 Sampling Event. The purpose of the August 2009 sampling event was to collect additional subslab VOC samples to evaluate temporal variability, at the request of ADEC, and to collect additional subslab and indoor air radon samples to support site-specific attenuation factor development.

This event included sampling subslab soil gas from at least one unit of each duplex. Samples were collected from both units of Buildings 15, 17, 22, 24, 48, and 49, beneath which known or suspected buried debris exists. At all other buildings, the housing unit with the highest risk or hazard estimates calculated from the December 2008 event were selected for subslab soil gas sampling.

All housing units that were previously sampled for radon as part of the March 2009 sampling event were resampled to support the site-specific attenuation factor development.

Sample information is presented in Table E-23 and the results of the August 2009 sampling event are provided in Appendix I, Tables I3-2a through I3-2c (target analytes in soil gas) and Appendix N (radon in soil gas and indoor air and target analytes in indoor air) and discussed in Sections 5 and 7.

Surface Soil Sampling. Additional surface soil samples were collected on March 23, 2009, to supplement the 2008 surface soil sample set and provide additional coverage of the FCS site. Surface soil sample information is provided in Table E-24, and sample locations are shown in Figure E-33. Analytical results are presented in Appendix I, Table I1-6c.

2010 RI Field Activities

2010 RI field activities were designed to build on and complete data sets collected during the 2009 RI activities and previous investigations. The investigative activities carried out in 2010 include the following:

- Additional investigation of a suspected DDT hot spot north of Building 19
- January 2010 subslab soil gas and indoor air sampling for radon

Investigation of DDT Hot Spot North of Building 19. A single elevated concentration of DDT was discovered during a final review of the soil sample data for the risk assessment. The concentration of DDT at sample 09-FWA-EXBLD15-20_1, located approximately 1 foot bgs within the southwest sidewall of the 2009 intrusive investigation footprint north of Building 19 at Taku Gardens was 46.5 mg/kg. The sample was analyzed for GRO, DRO, RRO, VOCs, SVOCs, herbicides, pesticides, explosives, and metals, and no other exceedances were found.

Additional investigation of the DDT hotspot was conducted in April 2010. A work plan addendum describing the procedures for the additional investigation and delineation of the DDT hotspot was submitted to ADEC for review prior to conduct of the investigation. Snow was cleared around the hot spot and the underlying soil was heated using a glycol-filled ground heater to thaw the ground to a depth of at least 3 feet bgs in a 10-foot by 10-foot area centered on the sample location. The soil was excavated vertically until native soil was encountered (the sample location was buried with imported fill upon completion of the 2009 Building 15/17 drum and debris investigation). Samples were collected from the base of the excavation and from sidewalls composed of native soil (i.e., backfill was not sampled). The analytical results for the initial confirmation samples were reviewed, and the sample collected from the eastern sidewall at 1.5 feet bgs contained an elevated concentration of DDT (2.39 mg/kg compared with a PSL of 2.1 mg/kg). The eastern side of the excavation was extended another 5 feet horizontally and down to a depth of 3 feet bgs. Confirmation samples were collected from the sidewalls of the extended excavation. One sample contained a J-qualified concentration of 2.2 mg/kg, just above the PSL and below the Method 2 cleanup level for DDT. The 51 yd^3 of soil removed from the excavation was placed in Super Sacks® and transported the long-term stockpile cell on the south end of the FCS. The excavation and confirmation sample locations are shown in Figure E-34. More information about the 2010 hot spot investigation is provided in Appendix P.

January 2010 Subslab Soil Gas and Indoor Air Sampling Event. Based on discussions with ADEC during a December 8, 2009, project status meeting, additional radon sampling was conducted to evaluate attenuation factors from additional units, particularly those where screening levels were noted in subslab soil gas.

The five units previously sampled for VOCs in October and December 2008, and radon in March and August 2009, were sampled again in January 2010. Five units with the highest ADEC target level exceedances of the December 2008 and August 2009 events were also sampled for radon in subslab soil gas and indoor air. To strengthen the statistical power of the radon data, each of the 10 adjoining units were also sampled, resulting in paired subslab and indoor air samples from 20 units. The 2010 subslab soil gas and indoor air sample locations are shown in Figure E-35. More information about the January 2010 subslab soil gas and ambient air sampling event is provided in Appendix Q.

July 2010 Soil Gas and Ambient Air Sampling. This investigation was undertaken to supplement the RI and risk assessment. The objective of sampling was to further evaluate relationships between subslab soil gas and the vapor intrusion pathway at focused locations. Subslab soil gas and indoor air samples were collected from 12 living units representing the locations of the highest exceedances of ADEC Target Levels during the December 2008 and August 2009 subslab soil gas sampling events. If any meaningful vapor intrusion pathway were to exist at the FCS, it would be anticipated to be most detectable at the locations with the highest exceedances. Therefore, if it was demonstrated that a meaningful pathway from subslab sources was absent at these units, then the same would be true for other units where lower subslab VOC concentrations have been observed. The results and conclusions of this supplemental investigation are provided and discussed in Appendix R.

TABLE 2-1
Average Water Production Rate (2005 Through August 2010)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Monthly Data (2005 - 2010)

	Total Monthly Production (gallons)						Calculated Average Daily Rate (gpm)					
Month	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
January	64,049,000	49,983,000	51,863,400	70,715,800	74,439,100	64,072,000	1,435	1,120	1,162	1,584	1,668	1,435
February	54,985,400	45,390,000	49,969,700	70,157,000	49,025,000	56,568,000	1,232	1,017	1,119	1,572	1,098	1,267
March	54,417,400	51,898,400	65,628,200	74,705,300	62,672,000	60,908,000	1,219	1,163	1,470	1,674	1,404	1,364
April	51,844,300	46,633,400	65,882,600	73,173,200	13,129,976	61,158,000	1,161	1,045	1,476	1,639	294	1,370
May	54,411,000	49,397,600	85,929,200	75,225,500	64,094,000	40,550,000	1,219	1,107	1,925	1,685	1,436	908
June	55,309,000	52,304,600	81,322,700	75,363,300	64,606,000	37,542,400	1,239	1,172	1,822	1,688	1,447	841
July	56,569,800	50,725,300	75,400,000	NV	76,078,000	36,808,000	1,267	1,136	1,689	NV	1,704	825
August	55,645,000	47,870,300	74,745,800	75,036,300	68,548,000	40,694,000	1,247	1,072	1,674	1,681	1,536	912
September	16,192,600	44,660,500	73,336,800	73,507,400	64,862,000		363	1,000	1,643	1,647	1,453	
October	42,573,000	46,223,700	74,351,000	73,704,600	66,800,000		954	1,035	1,666	1,651	1,496	
November	44,142,500	48,658,800	71,865,500	72,517,000	67,810,000		989	1,090	1,610	1,624	1,519	
December	49,361,100	50,654,300	96,713,500	74,921,400	NV		1,106	1,135	2,167	1,678	NV	
Average	**49,958,342**	**48,699,992**	**72,250,700**	**73,547,891**	**61,096,734**	**49,787,550**	**1,119**	**1,091**	**1,619**	**1,648**	**1,369**	**1,115**

[a] Total adjusted monthly production, divided by number of days in month, divided by 1,440 minutes per day

Shaded values are 2X the reported monthly production value (recent testing has shown than new equipment installed in 2009 underreports flow volume by about 50%)

* Minimum and maximum rates were excluded from average calculations

Average Monthly Production 2005 - 2010	59,223,535	gallons		
Average Pumping Rate 2005 - 2010	1,327	gpm		
Average per Capita Use Per Day at Ft Wainwright (population 12,000)	159	gallons per person per day		
American Water Works Association estimated per capital use nationwide	183	gallons per person per day	http://www.drinktap.org/consumerdnn/Home/WaterInformation/Conservation/WaterUseStatistics/	
If each of the 55 duplexes is occupied by 2 families, each with up to 5 family members, the increase in Ft. Wainwright population would be:	550	people		
Potential increase in water needed (based on average per capita use) :	87,561.99	gallons per day	or	60.81 gpm
Number of additional personnel required to change pumping rate to 1,700 gpm (difference of 373 gpm)	3377	people		

TABLE 2-2
Monitoring Well Location and Construction Information
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

	Survey Information			Construction Information			
Well ID	**Northing**	**Easting**	**Elevation**	**Total Depth (feet bgs)**	**Top of Screen (feet bgs)**	**Bottom of Screen (feet bgs)**	**Rationale for Continued Monitoring**
MW01	7188884.77	468163.69	447.3	22.0	12.0	22.0	
MW02	7188916.05	468213.05	449.2	18.0	7.5	17.5	
MW03	7188960.68	468213.77	447.8	20.0	9.5	19.5	Dieldrin exceedance 2007
MW04	7188945.34	468332.34	447.6	18.0	7.5	17.5	
MW05	7189287.71	468101.55	447	20.0	9.5	19.5	
MW06a	7189283.14	468300.13	448	21.0	10.5	20.5	POL plume
MW06b	7189283.08	468304.21	448.1	22.5	17.0	22.0	
MW07	7189286.86	468610.77	448.4	20.0	9.5	19.5	
MW08	7189084.58	468672.38	451.1	19.5	9.0	19.0	Capture zone, 1,2,3-TCP
MW09	7188850.37	468669.25	450.1	19.0	8.5	18.5	
MW10	7189149.3	468412.13	445.9	20.0	9.5	19.5	
MW11	7189130.55	468529.01	448.3	20.0	9.5	19.5	
MW12	7189208.03	468341.29	447.5	19.0	8.5	18.5	POL plume
MW13	7188850.7	468561.99	448.81	18.0	7.0	17.0	Downgradient of Subarea D anomaly
MW14	7188828.85	468452.11	448.5	18.0	7.0	17.0	
MW15	7188865.54	468349.18	448.746	18.0	7.0	17.0	
MW16	7188811.08	468236.77	449.212	19.0	8.0	18.0	
MW17	7188899.8	468198.9	447.498	18.0	7.0	17.0	
MW18	7188874.18	468509.64	447.201	18.0	6.9	16.9	
MW19	7189041.39	468219.13	447.254	18.0	6.7	16.7	
MW20	7189007.2	468251.94	447.468	18.0	7.0	17.0	
MW21	7188980.3	468324.56	448.447	18.0	7.0	17.0	
MW22	7189014.43	468345.14	446.873	18.0	7.0	17.0	
MW23	7189071.28	468363.42	446.98	18.0	7.0	17.0	
MW24	7189110.7	468339.58	447.065	18.0	7.0	17.0	
MW25	7189155.07	468275.29	447.007	18.5	7.6	17.6	
MW26	7189114.22	468221.23	446.865	18.0	6.7	16.6	Site coverage, western boundary of FCS
MW27	7189153.43	468361.92	446.598	18.0	6.9	16.9	
MW28	7189192.17	468292.68	449.882	19.5	8.5	18.5	
MW29	7189198.58	468258.96	448.663	19.0	8.0	18.0	
MW30	7189206.87	468172.53	447.299	18.0	7.0	17.0	
MW31	7189239.33	468166.12	447.124	17.5	7.0	17.0	
MW32	7189241.33	468251.38	448.702	20.5	9.0	19.0	POL plume boundary
MW33	7189236.57	468332.98	447.917	18.5	8.0	18.0	POL source area (max detects)
MW34	7189315.68	468166.03	443.361	16.0	4.9	14.9	
MW35	7189378.38	468207.02	446.055	18.0	6.4	16.4	POL plume, downgradient area
MW36	7189446.34	468131.82	447.67	19.0	7.0	17.0	Coverage, northern boundary of FCS
MW37	7189412.24	468265.22	447.553	18.0	7.0	17.0	POL and TCE plume, downgradient area
MW38	7189389.76	468453.5	447.249	19.0	7.2	17.2	TCE plume, northern boundary of FCS
MW39	7189278.62	468651.8	448.606	31.0	9.6	29.6	Deep well, capture zone
MW40	7189325.57	468643.28	449.71	51.0	29.3	49.3	Deep well, capture zone
MW41	7189332	468573.98	448.48	18.5	7.5	17.5	
MW42	7189306.32	468524.89	448.315	19.0	8.0	18.0	
MW43	7189333.706	468397.432	446.848	18.0	7.0	17.0	TCE plume, within former Hoppe's slough
MW44	7189231.47	468402.26	447.492	18.0	7.5	17.5	
MW45	7189202.24	468515.28	447.94	18.5	7.5	17.5	TCE plume, eastern boundary of FCS
MW46	7189230.6	468575.66	448.224	18.5	7.6	17.6	
MW47	7189196.45	468639.85	448.799	18.0	7.0	17.0	Capture zone, 1,2,3-TCP plume
MW48	7189130.27	468629.17	449.069	18.5	7.5	17.5	Capture zone
MW49	7189078.44	468622.2	449.4	19.0	8.0	18.0	
MW50	7189103.42	468564.35	448.992	18.0	7.0	17.0	
MW51	7189074.81	468523.13	447.841	18.0	7.0	17.0	
MW52	7189075.01	468426.02	449.535	18.0	7.0	17.0	
MW53	7189013.73	468475.46	448.961	18.0	7.0	17.0	TCE exceedance, 2007
MW54	7188991.38	468385.04	446.627	18.0	7.0	17.0	
MW55	7188947.15	468413.9	449.007	18.5	7.5	17.5	
MW56	7189152.9	468453.61	446.403	18.0	6.8	16.8	TCE and PCE plume
MW57	7188950.88	468657.77	450.085	18.5	7.4	17.4	Coverage, southeastern boundary of FCS
MW58	7189310.72	468272.02	448.981	20.0	9.0	19.0	POL plume, south of SAS
MW59	7189123.3	468423.66	448.532	18.0	7.0	17.0	
MW60	7189078.6	468488.6	447.275	18.0	7.0	17.0	
MW61	7189181.49	468442.33	447.942	18.0	7.0	17.0	TCE and PCE plume (max detects)

TABLE 2-2

Monitoring Well Location and Construction Information

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

	Survey Information			Construction Information			
Well ID	Northing	Easting	Elevation	Total Depth (feet bgs)	Top of Screen (feet bgs)	Bottom of Screen (feet bgs)	Rationale for Continued Monitoring
MW62	7189252.68	468400.42	447.686	18.0	7.0	17.0	TCE plume
MW63	7189251.66	468352.58	448.649	18.0	7.0	17.0	
MW64	7189276.65	468362.94	447.463	18.0	7.0	17.0	TCE and POL plume
MW65	7189276.42	468323.19	447.804	18.0	7.0	17.0	
MW67	7189278.12	468266.33	448.49	18.0	7.0	17.0	
MW68	7189126.05	468563.35	448.978	18.0	7.0	17.0	
MW69	7189099.52	468587.25	448.354	18.0	7.0	17.0	SVOC and PAH exceedances, 2007
MW70	7189006.01	468579.53	449.475	18.0	7.0	17.0	1,2-DCA exceedance, 2007
MW71	7188983.07	468518.38	448.963	18.0	7.0	17.0	
MW72	7188947.85	468560.63	448.681	18.0	7.0	17.0	
MW73	7188940.85	468498.14	449.547	18.0	7.0	17.0	
MW74	7188874.75	468189.63	448.261	19.0	8.0	18.0	
MW76	7188802.5	468190.84	448.266	18.0	7.0	17.0	Perimeter of PCB EZ
MW77	7189388.411	468390.573	NM	21.5	11.5	21.5	TCE and POL, northern boundary of FCS
MW78	7189246.424	468664.57	NM	37.5	27.5	37.5	Deep well, capture zone
MW79	7189161.374	468660.234	NM	21.5	11.5	21.5	Capture zone, 1,2,3-TCP plume
MW80	7189173.626	468453.232	NM	49.0	39.0	49.0	Deep well, TCE and PCE plume
MW81	7188873.51	468223.637	NM	21.5	11.5	21.5	PCB excavation
MW82	7189523.768	468315.38	480.13	20.0	10.5	20.0	TCE and POL plume, downgradient delineation
MW83	7189527.318	468250.214	479.91	20.0	10.0	20.0	TCE and POL plume, downgradient delineation
MW84	7189521.005	468399.989	480.77	20.0	9.0	19.0	TCE and POL plume, downgradient delineation
MW85	7189267.131	468765.974	481.75	20.0	9.5	19.5	1,2,3-TCP, delineation in capture zone
MW86	7189240.064	468739.144	481.18	20.0	9.5	19.5	1,2,3-TCP, delineation in capture zone
MW87	7189180.034	468741.923	481.14	20.0	9.5	19.5	1,2,3-TCP, delineation in capture zone
MW88	7189014.942	468747.937	480.87	20.0	9.5	19.5	1,2,3-TCP, delineation in capture zone
MW89	7189171.455	468846.34	487.63	25.0	14.5	24.5	1,2,3-TCP, delineation in capture zone
MW90	7188938.963	468796.037	484.88	20.0	9.5	19.5	1,2,3-TCP, delineation in capture zone

Horizontal Control: Coordinates are Alaska State Plane Zone 3, NAD83 (1966) in feet

Vertical Control: Elevations are NAVD88 U.S. Survey Feet.

Bolded font indicates wells that are part of the semi-annual groundwater sampling program for the FCS

Wells MW77 through MW81 were installed and first sampled in 2008

Wells MW82 through MW90 were installed and first sampled in late 2009

bgs = below ground surface

SAS = School Age Services

TABLE 2-3
FCS Investigations Conducted Before the Remedial Investigation
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Month & Year	Lead(s)	Reference	Activity
Oct. 2003	Cold Regions Research and Engineering Laboratory (CRREL) Shannon & Wilson (S&W)	CRREL, 2003 S&W, 2003	Limited geophysical and soil boring/soil sampling investigation. Five soil borings were advanced, and surface and subsurface soil samples were analyzed for VOCs, GRO, DRO/RRO, and lead.
Nov. 2003 to Feb. 2004	U.S. Army Corps of Engineers (USACE)	USACE, 2004a, 2004b, 2004c, and 2004d	Geotechnical and environmental soil condition investigations at the FCS in preparation of future family housing development. A total of 76 soil borings were advanced to a depth of 10 to 50 feet bgs.
March to Sept. 2004	U.S. Army	U.S. Army, 2004 USACE, 2006	Site clearing and vegetation removal activities began at the Taku Gardens subdivision. Site soil was used to construct the sound berm along the eastern and southeastern boundaries of the FCS. Extensive amounts of buried items, scrap metal, drums and MEC items were uncovered in the northeastern section of the FCS. Military ordnance experts assisted in characterizing and disposing of the MEC items and prepared EOD reports.
May 2004	R&M Consultants, Inc. (R&M)	R&M, 2004	Geophysical survey conducted prior to housing construction because metal debris had been encountered during the earlier geotechnical and geophysical investigations.
June 2004	U.S. Army	U.S. Army, 2004	Environmental assessment of replacement family housing construction at the Taku Gardens subdivision.
March – April 2005	North Wind	North Wind, 2005 North Wind, 2006b	Investigated the presence of PCBs in soil at two locations identified during the 2003–2004 geotechnical investigation. Eight soil borings were installed.
April 2005	U.S. Army Watterson Construction	Oasis, 2007 North Wind, 2006a	Construction of Taku Gardens housing units began. Soil and debris were removed and stockpiled around the site as part of foundation, utility trench, and roadway construction. Military ordnance experts assisted in characterizing and disposing of the MEC items and prepared EOD reports.
April to Oct. 2005	Shannon & Wilson Watterson Construction	S&W, 2006a	Monitored and field screened excavation soils for POL contamination during subdivision construction activities. Soil exceeding the 20-ppm action level was encountered at 20 locations, was field screened, and was segregated into >20-ppm and >100-ppm stockpiles on the FCS.

TABLE 2-3
FCS Investigations Conducted Before the Remedial Investigation
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Month & Year	Lead(s)	Reference	Activity
June 2005	North Wind	North Wind, 2006b	Petroleum contamination was discovered in the north-central area of the Taku Gardens subdivision (in the vicinity of Buildings 5 through 9) during housing construction. Soil boring and groundwater samples were collected.
June 2005	North Wind	North Wind, 2006b	Solventlike odor was detected during foundation construction at Building 52.
June to Oct. 2005	North Wind	North Wind, 2006b	Investigation focused on protection of construction workers and nearby residents, including collection of soil and groundwater samples for POL and PCB analysis in target areas and from soil stockpiles. Surface wipe sampling was conducted at nearby residences, on onsite construction equipment, and at onsite structures to evaluate potential for PCB-contaminated dust. Investigation also included offsite (i.e., non-FCS) flower beds/pots where soil from the FCS had been used. Results from the flower bed and pot samples also confirmed that contaminated soil had been used as potting soil. The contaminated flower pots and soil were removed and stockpiled with other PCB-contaminated soil within the Building 52 excavation. In addition, the trench excavation where utility lines crossed the property/driveway of Bldg. 4394, a residence located west of Building 51, contained low levels of Aroclor 1260 at concentrations less than 1 mg/kg. Soil excavated from the contaminated site was used to backfill the utility line excavation. North Wind removed the contaminated soil during the phase of the project when Area 52 stockpiled soil was loaded into roll offs (connexes) at the site. The Fort Wainwright DPW was responsible for filling the excavation with clean soil.
Sept. 2005	U.S. Army	U.S. Army Garrison, Alaska, 2007	Time Critical Removal Action (TCRA) for PCBs was conducted at the FCS.
Sept. 2005	U.S. Army	North Wind, 2006b Oasis, 2007	Construction of the housing units continued, except in the PCB area exclusion zone. POL-contaminated soil stockpiles were transported and constructed at the DRMO yard. A temporary settling pond for stormwater and sediment runoff control from the PCB area exclusion zone was constructed
Sept. 2005	Oasis Environmental, Inc. (Oasis)	Oasis, 2007	Army initiated a Preliminary Source Evaluation (PSE) in compliance with the Fort Wainwright Federal Facility Agreement. The first phase of the PSE (PSE I) integrated historical information with incidental findings of debris and contamination that had been reported since site clearing and construction of the Taku Gardens subdivision began in 2003.

TABLE 2-3
FCS Investigations Conducted Before the Remedial Investigation
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Month & Year	Lead(s)	Reference	Activity
Sept. 2005 to Sept. 2006	North Wind	North Wind, 2007	The second phase of the PSE (PSE II) included excavation of test pits to characterize geophysical anomalies, supplemental geophysical surveys by Sage Earth Science, screening of stockpiled debris and soils around the Taku Gardens subdivision, installation of monitoring wells, and collection of additional soil, soil gas, and groundwater samples to characterize site conditions.

bgs = below ground surface
DRO = diesel-range organics
EOD = explosive ordnance device
GRO = gasoline-range organics
MEC = munitions and explosives of concern
PCB = polychlorinated biphenyl
POL = petroleum, oil, and lubricants
ppm = parts per million
PSE = Preliminary Source Evaluation
RRO = residual-range organics
VOC = volatile organic compound

TABLE 2-4
2007 Sample Summary
Former Communications Site, Fort Wainwright, Alaska

		Explosives		Herbicides	Metals			PAH	PCBs	Pesticides	SVOC	TPH					VOC	
Soil Category	**Total Number of Samples**	**SW8321A**	**SW8330**	**SW8151A**	**SW6010B**	**SW6020**	**SW7471A**	**SW8270SIM**	**SW8082**	**SW8081A**	**SW8270C**	**AK101**	**AK102**	**AK103**	**NWEPH**	**NWVPH**	**SW8260B**	**SW8260Low**
Soil Pile Samples (MI)*	44	0	0	0	27	27	27	0	18	0	24	0	22	22	0	0	8	0
Soil Pile Samples (discrete)	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0
Soil Pile Conrfimation Samples	11	0	0	0	0	5	0	0	0	6	0	6	6	6	0	0	0	0
Sound Berm Samples (MI)*	11	0	9	9	9	9	9	0	9	9	9	9	9	9	0	0	9	0
Excavation Confirmation Samples	425	81	0	85	81	81	81	80	328	81	82	81	81	81	0	0	82	75
Soil Boring Samples	189	151	0	189	187	187	187	187	30	187	187	184	187	187	20	34	184	183
Sediment Samples	3	3	0	3	3	3	3	3	0	3	3	3	3	3	3	3	3	3
Total Soil Samples	**684**	**235**	**9**	**286**	**307**	**312**	**307**	**270**	**385**	**286**	**305**	**283**	**309**	**309**	**23**	**37**	**287**	**261**

*MI sample totals include field duplicates and triplicates .

		Explosives		Herbicides	Metals			PAH	PCBs	Pesticides	SVOC	TPH					VOC
Groundwater	**Total Number of Samples**	**SW8321A**	**SW8330**	**SW8151A**	**SW6010B**	**SW6020**	**SW7470A**	**SW8270SIM**	**SW8082**	**SW8081A**	**SW8270C**	**AK101**	**AK102**	**AK103**	**NWEPH**	**NWVPH**	**SW8260B**
Spring 2007 Groundwater Samples	13	10	10	10	0	13	13	0	13	13	13	13	13	13	0	0	13
Fall 2007 Groundwater Samples	73	57	0	73	73	73	72	72	13	73	73	73	73	73	5	5	73
Total Groundwater Samples	**86**	**67**	**10**	**83**	**73**	**86**	**85**	**72**	**26**	**86**	**86**	**86**	**86**	**86**	**5**	**5**	**86**

	VOC
Air/Soil Gas	**TO-15**
Outdoor Ambient Air	6
Vadose Zone Soil Gas	54
Subslab Soil Gas	122
Total Air Samples	**182**

In accordance with the RI Work Plan, an extensive list of target analytes list was used for most non-waste samples collected during the RI. This analyte list included DRO, RRO, GRO and individual analytes that compose the VOC, SVOC, metals, pesticides, and herbicides analytical suites. In addition, samples from subareas where munitions-related items had been observed or were suspected were analyzed for chemicals associated with explosives, and sample collected in areas where PCBs had been found during the FCS-wide 2005 PCB investigation were analyzed for PCBs. The only exceptions to use of the broad list of target analytical suites were soil samples collected to confirm delineation and/removal of specific contaminant hotspots (e.g. PCBs in Subarea E, or the pesticide hotspot at Building 11) and soil and groundwater samples collected to support delineation of the northern plumes.

MI = multi-incremental
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

TABLE 2-5
2008 Sample Summary
Former Communications Site, Fort Wainwright, Alaska

Soil Category	Total Number of Samples	Explosives SW8321A	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7471A	PAH SW8270 SIM	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8260B-Low	TPH AK101	TPH AK102	TPH AK103
Excavation Confirmation	244	191	44	191	191	191	191	69	196	191	191	191	191	36	209
Soil Boring	14	10	13	13	13	13	13	1	13	3	13	13	13	13	13
Soil Pile Confirmation	24	2	2	16	16	16	6	2	20	8	12	2	20	20	20
Sound Berm Discrete	20	0	0	0	0	0	20	0	0	0	0	0	0	0	0
Surface Soil	78	33	78	78	78	78	78	0	78	78	78	0	78	78	78
Total Soil Samples	**380**	**236**	**137**	**298**	**298**	**298**	**308**	**72**	**307**	**280**	**294**	**206**	**302**	**147**	**320**

Groundwater	Total Number of Samples	Explosives SW8321A	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7470A	PAH SW8270 SIM	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8260B-Low	TPH AK101	TPH AK102	TPH AK103	TPH NWEPH	TPH NWVPH
Spring 2008 Groundwater Samples	28	23	27	28	28	28	28	3	28	28	28	28	28	28	28	7	7
Fall 2008 Groundwater Samples	34	31	34	34	34	34	34	3	34	34	34	34	34	34	34	8	9
Total Groundwater	**62**	**54**	**61**	**62**	**62**	**62**	**62**	**6**	**62**	**62**	**62**	**62**	**62**	**62**	**62**	**15**	**16**

Waste	Total Number of Samples	Explosives SW8270C	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7471A	PAH SW8270C	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8270C	GEN CHEM SW1020A	GEN CHEM SW9012A	GEN CHEM SW9034
2008 Excavation Waste Samples	12	6	12	6	6	6	6	6	12	**6**	6	6	6	6	6

Air Category	VOC TO-15
October 2008 Ambient Air	1
October 2008 Indoor Air	10
October 2008 Soil Gas	10
December 2008 Ambient Air	6
December 2008 Indoor Air	10
December 2008 Soil Gas	110
Total Air Samples	**147**

In accordance with the RI Work Plan, an extensive list of target analytes list was used for most non-waste samples collected during the RI. This analyte list included DRO, RRO, GRO and individual analytes that compose the VOC, SVOC, metals, pesticides, and herbicides analytical suites. In addition, samples from subareas where munitions-related items had been observed or were suspected were analyzed for chemicals associated with explosives, and sample collected in areas where PCBs had been found during the FCS-wide 2005 PCB investigation were analyzed for PCBs. The only exceptions to use of the broad list of target analytical suites were soil samples collected to confirm delineation and/removal of specific contaminant hotspots (e.g. PCBs in Subarea E, or the pesticide hotspot at Building 11) and soil and groundwater samples collected to support delineation of the northern plumes.

Notes:
Sample totals do not include field duplicates

PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

TABLE 2-6
2009 Sample Summary
Former Communications Site, Fort Wainwright, Alaska

Soil Category	Total Number of Samples	Explosives SW8321A	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7471A	PAH SW8270 SIM	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8260B-Low	TPH AK101	TPH AK102	TPH AK103	General Chemistry A2540G
Excavation Confirmation	71	60	3	57	60	60	60	1	60	71	71	60	71	71	71	3
Sound Berm	20	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0
PCB Investigation Confirmation	90	0	0	0	9	9	9	90	9	9	9	9	9	9	9	0
Soil Boring - Northern Plume Delineation	26	0	0	0	0	0	0	0	0	0	26	0	0	26	26	26
Soil Boring - 1,2,3-TCP Investigation	12	0	0	0	0	0	12	0	0	0	12	12	12	0	0	12
Surface Soil	8	3	8	8	8	8	8	0	8	8	8	0	8	8	8	0
Total Soil Samples	**227**	**63**	**11**	**65**	**77**	**77**	**109**	**91**	**77**	**88**	**126**	**81**	**100**	**114**	**114**	**41**

Groundwater	Total Number of Samples	Explosives SW8321A	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7470A	PAH SW8270 SIM	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8260B-SIMLow	TPH AK101	TPH AK102	TPH AK103	TPH NWEPH	TPH NWVPH	Dioxin/Furan SW8290
2009 Spring Groundwater Samples	29	22	25	10	25	25	24	5	25	25	34	27	27	27	27	6	6	1
2009 Fall Groundwater Samples	34	29	33	18	34	34	34	7	34	34	29	32	31	34	34	5	5	1
2009 Northern Plume Delineation	17	0									17	17		17	17			
2009 1,2,3-TCP Investigation	8	4	4	2	4	4	8		4	4	8	8	4	4	4	4	4	
Total Groundwater Samples	**88**	**55**	**62**	**30**	**63**	**63**	**66**	**12**	**63**	**63**	**88**	**84**	**62**	**82**	**82**	**15**	**15**	**2**

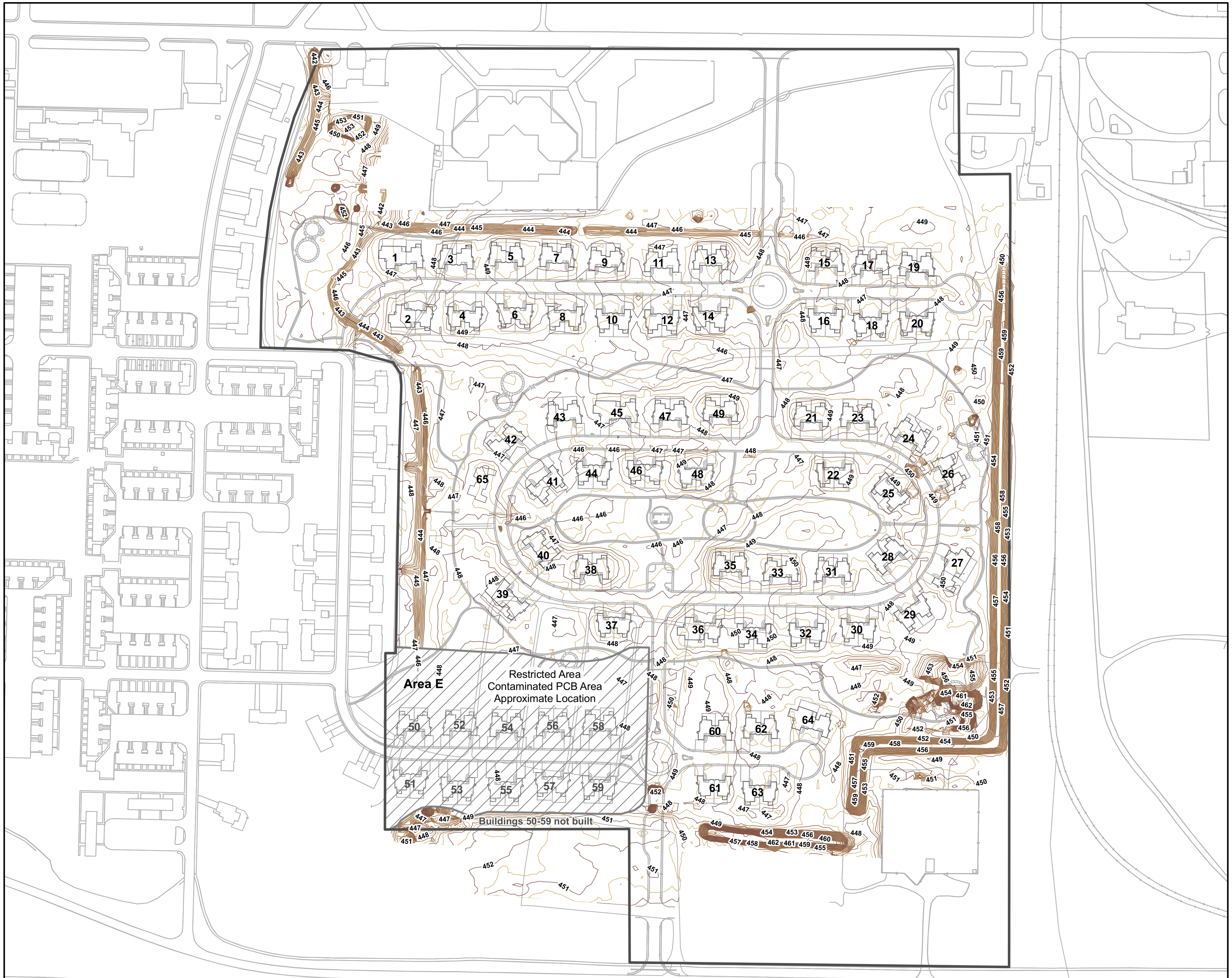
Waste	Total Number of Samples	Explosives SW8321A	Herbicides SW8151A	Metals SW6010B	Metals SW6020	Metals SW7470A /7471A	PAH SW8270 SIM	PCBs SW8082	Pesticides SW8081A	SVOC SW8270C	VOC SW8260B	VOC SW8260B-SIMLow	TPH AK101	TPH AK102	TPH AK103	TPH NWEPH	TPH NWVPH	Dioxin/Furan SW8290
2009 Waste Samples (liquids)	4	4	4	2	4	4	4	0	4	4	4	4	4	4	4	1	1	0
2009 Waste Samples (soil and solids)	40	23	2	13	23	23	32	3	3	23	40	40	40	40	40	0	0	3
2009 Building 9 Stockpiles	12	12	3	12	12	12	3	7	7	12	12	12	12	12	12	0	0	0
Total Waste Samples	**56**	**39**	**9**	**27**	**39**	**39**	**39**	**10**	**14**	**39**	**56**	**56**	**56**	**56**	**56**	**1**	**1**	**3**

Air Category	Total Number of Samples	VOC TO-15	VOC TO-15-SIM	Radon EPAGSSC
March 2009 Ambient Air	1	0	0	1
March 2009 Indoor Air	12	2	0	10
March 2009 Soil Gas	12	2	0	10
August 2009 Ambient Air	2	2	2	2
August 2009 Indoor Air	5	0	0	5
August 2009 Soil Gas	61	61	61	5
Total Air Samples	**93**	**67**	**63**	**33**

In accordance with the RI Work Plan, an extensive list of target analytes list was used for most non-waste samples collected during the RI. This analyte list included DRO, RRO, GRO and individual analytes that compose the VOC, SVOC, metals, pesticides, and herbicides analytical suites. In addition, samples from subareas where munitions-related items had been observed or were suspected were analyzed for chemicals associated with explosives, and sample collected in areas where PCBs had been found during the FCS-wide 2005 PCB investigation were analyzed for PCBs. The only exceptions to use of the broad list of target analytical suites were soil samples collected to confirm delineation and/removal of specific contaminant hotspots (e.g. PCBs in Subarea E, or the pesticide hotspot at Building 11) and soil and groundwater samples collected to support delineation of the northern plumes.

Notes:
Sample totals do not include field duplicates

PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbon
VOC = volatile organic compound



LEGEND

Site Boundary

1-ft Contour

0.5-ft Contour

0 275
Feet

N

FIGURE 2-1
FCS Topography
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone
- 2007 Groundwater Elevation Contour (Feet above Mean Sea Level - NAVD88)
- Deep Groundwater Monitoring Well Location
- Shallow Groundwater Monitoring Well Location

0 275
Feet

N

FIGURE 2-2
Groundwater Elevation Contour Map
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\SIMBA\PROJ\USARMYCORPSOFENGINEE\357465TAKUGARDENS\GIS\MAPFILES\RI_2009\FIG2-2_GWELEVATION.MXD DMORIN1 4/7/2009

CH2MHILL

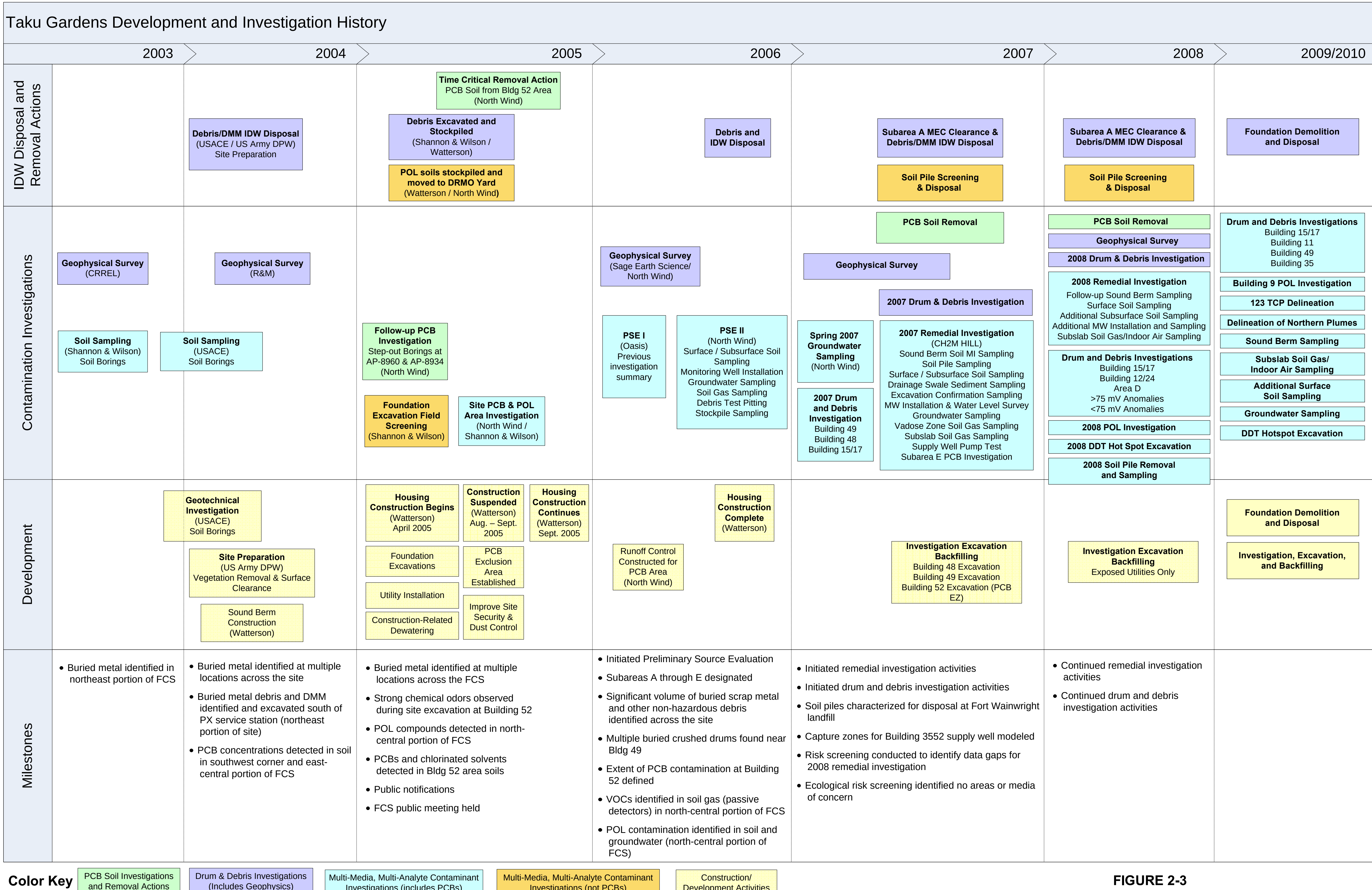


FIGURE 2-3
FCS Development and Investigation Chronology
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

SECTION 3

Remedial Investigation Approach

This section presents the approach for conducting the RI at the FCS, including the CSM that guided the RI as it progressed, the data and evaluation criteria used in the nature and extent of contamination and fate and transport evaluations, and the tiered approaches used for the human and ecological risk assessments for the FCS.

3.1 Preliminary Conceptual Site Model Development

A CSM provides a framework for understanding site-specific features and physical processes that influence the potential for risk, and it describes potential human and ecological exposure pathways for site-related chemicals. CSMs include the following components:

- **Sources of contaminants:** Based on known or suspected historical uses, practices, and releases at the FCS.
- **Receptors:** These are human and ecological populations that could be exposed to the contaminants at or near the FCS.
- **Pathways:** These describe the mechanism through which a chemical could come into contact with receptors. An exposure pathway is considered complete when a contaminant can be tracked from its source to a receptor.

A preliminary CSM was constructed during the RI planning process to facilitate the development of investigative strategies and data quality objectives. The preliminary CSM was developed based on review of the physical characteristics of the FCS (see Section 2.1), operational history of the FCS (see Section 2.2), historical aerial photographs and maps (see Appendix C), and the results of pre-RI investigations (see Section 2.3). The preliminary pictorial CSM for the FCS is shown on Figure 3-1. The following sections describe the source, receptor, and pathway components included in the preliminary CSM. Figure 3-2 is the preliminary CSM that also shows the various investigative techniques used during the RI to characterize the site. Through the progression of the RI and improved characterization of the FCS, the preliminary CSM was updated (see Section 5.5) and a conceptual exposure model (CEM) was developed (see Section 7.4).

3.1.1 Contaminant Sources and Release Mechanisms

The primary sources of contaminants and release mechanisms at FCS include those associated with former operations at the various sites. These sources include the following:

- Spillage and leakage from storage tanks, transformers, and drums
- Substances placed in historical landfills
- Substances used in possible fire training areas
- Leaking pipelines

The risk assessments evaluate residual contaminants associated with past operations, which include POL, PCBs, pesticides, solvents, PAHs, metals, and munitions/explosive residues.

3.1.2 Environmental Transport Media

The plausible mechanisms transporting the COPCs from their sources, through environmental media, to potential receptors include the following:

- Volatilization of vapors from groundwater and subsurface soil to soil gas and indoor air
- Dust or vapors generated from wind or mechanical erosion
- Infiltration/percolation and leaching of contaminants to groundwater
- Migration of groundwater to the deeper FWA water supply wells
- Discharge of groundwater to offsite surface water and sediment
- Surface drainage and runoff during storm events or snowmelt
- Movement of contaminated soil during construction and pre-RI activities (soil piles and sound berm)

3.1.3 Potentially Complete Human Exposure Pathways and Receptors

On the basis of current understanding of land and water beneficial use conditions at or near the FCS, the most plausible exposure scenarios considered for characterizing human health risks include the following:

- **Future Maintenance Worker Scenario:** Under future site conditions, workers could be exposed to surface soil during maintenance activities at the FCS. Potential routes of exposure to surface soil (0 to 2 feet bgs) for the maintenance worker would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors.

- **Future Excavation Worker Scenario:** Under future site conditions, excavation workers could be exposed to subsurface soil during infrequent excavation activities at the FCS. These activities could include placement or repair of utilities or other construction activities involving digging. Potential routes of exposure to subsurface soil (0 to 15 feet bgs) for the excavation worker would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors generated during excavation activities. Exposure to groundwater is not evaluated because the likelihood of encountering groundwater within 15 feet of the ground surface is low (see depths to groundwater in Table E-12c of Appendix E); furthermore, horizontal utilities at the site do not exist below 8 feet bgs.

- **Future Recreational/Site Visitor Scenario:** Future recreationalists and site visitors may use common areas and open space that surrounds the residential areas. The current FCS plans indicate playground areas, a sledding hill, and an ice skating rink. For surface soil (0 to 2 feet bgs), the plausible exposure routes would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors.

- **Reasonably Anticipated Future Residential Exposure Scenario:** Given the anticipated future uses at the FCS, residents are expected to live at the FCS. This scenario is included to provide support for Army risk management decisions for military occupation in the housing units, and includes consideration of existing restrictions that preclude digging onsite, and prevent use of groundwater from areas outside the capture zone of the existing FWA supply wells. For surface soil (0 to 2 feet bgs), the exposure routes for the future resident would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors. For soil gas, the exposure route would be inhalation of VOC vapors emanating from groundwater or subsurface soil into indoor air. Additionally, should contaminants in groundwater from the FCS migrate to the FWA water supply wells, exposure to contaminants in drinking water and during showering/bathing activities would represent complete pathways.

- **Hypothetical Future Unrestricted Exposure Scenario:** This scenario is evaluated in accordance with ADEC guidance and includes default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and irrespective of the existence of current or future measures precluding exposure to these media. For soil (0 to 15 feet bgs), the exposure routes for the unrestricted scenario would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors. For soil gas, the exposure route would be inhalation of VOC vapors emanating from groundwater or subsurface soil into indoor air. For groundwater, exposure routes would include drinking, dermal contact, and vapor inhalation during showering/bathing activities.

It is important to note that the HHRA is evaluated under two distinct sets of assumptions regarding potential future exposures at the site (as defined in the last two bullets above) to accommodate the respective needs both of ADEC regulatory requirements and the Army risk management decisions for military occupation in the housing units. When interpreting the results of the HHRA, it is critical that there be logical separation between these two evaluation approaches, and a clear understanding of the intended uses of the respective results for decision making.

3.1.4 Potentially Complete Ecological Exposure Pathways and Receptors

Based on the ecoscoping forms for the FCS presented in Appendix F of the *Preliminary Source Evaluation 1 Narrative Report, Former Communications Site, Fort Wainwright, Alaska, Interim Final* (Oasis, 2007), plausible ecological exposure pathways considering the COPCs, available habitat, and available food sources at the FCS consist of the following:

- Potential exposures of aquatic resources and piscivorous (fish-eating) wildlife to chemicals in groundwater that could reach the Chena River
- Potential exposure of terrestrial wildlife (mammals and birds) to site-related chemicals in sediment from drainage swales adjacent to the FCS
- Hypothetical exposure of benthic macroinvertebrates to drainage swale sediments that could be migrating to the Chena River

3.2 Nature and Extent Evaluation Approach

The objective of the nature and extent of contamination evaluation was to characterize the sources of contamination at the FCS and assess the distribution of related contaminants in FCS media. The nature and extent of contamination evaluation consisted of (1) a qualitative assessment of historical contaminant sources in the FCS, as determined through the pre-RI and RI excavations and waste characterization activities; and (2) a quantitative evaluation of the nature and extent of residual contamination in environmental media at the FCS.

The approach for the source characterization evaluation consisted of compiling and reviewing information about the materials found in the subsurface during construction activities, drum and debris investigations, and removal of contaminated soil. Although primarily a qualitative evaluation, the source characterization evaluation also focused on available analytical data for samples of soil and waste recovered during these activities, or from soil piles associated with these activities, and then comparing the sample results with conservative screening levels and background (as appropriate) to identify COIs associated with the sources.

The approach for evaluating the quantitative residual nature and extent of contamination included comparing analytical data of appropriate quality for samples collected across the FCS to conservative screening levels and background (as appropriate), to determine which chemicals exceeded those levels (COI), and map the distribution of those chemicals in FCS media. The nature and extent evaluation is not to be confused with the risk assessments, which are separate sets of evaluations that considered site-specific and cumulative exposures to chemicals in FCS media, the approaches for which are described in Sections 3.4 and 3.5.

3.2.1 Target Analytes for the Remedial Investigation

As indicated in Section 2.3, the target analyte list for the RI was extensive because of the variety of historical operations and disposal activities that occurred in the FCS. The analyte list included GRO, DRO, and RRO), as analyzed for using Alaska (AK) Methods 101, 102, and 103, and individual analytes that compose the VOC, SVOC, metals, pesticides, and herbicides lists.

Per Table 2A of the *Guidance for Treatment of Petroleum Contaminated Soil and Water and Standard Sampling Procedures* (ADEC, 2002a), the AK101 method detects and quantifies POL in the C6-C10 hydrocarbon range; this range typically encompasses automotive gasoline, aviation gasoline, JP-4, and arctic diesel. The AK102 method detects and quantifies POL in the C10-C25 range; this range encompasses JP-4, arctic diesel (overlaps with AK101), #2 diesel, #3 to #6 fuel oils, JP-5, JP-8, Jet A, waste/used oil, and kerosene. The AK103 method detects and quantifies #3 to #6 fuel oils, waste/used oil, and kerosene (overlaps with AK102). It should be noted that AK Methods 101, 102, and 103 are gas chromatography methods for detection of volatile and semivolatile petroleum fractions. Other nonpetroleum compounds with similar characteristics and boiling points may also be detected with these methods (ADEC, 2002b–d). The GRO method may also detect and report chlorinated solvents, ketones, and ethers as GRO (ADEC, 2002b). The DRO and GRO methods may also detect and report animal and vegetable oil and grease, chlorinated hydrocarbons, phenols, phthalate esters and biogenic terpenes, as DRO and RRO (ADEC, 2002c, 2002d).

Tentatively identified compound (TIC) analysis was also performed for selected soil, groundwater, and soil gas samples collected during the RI. In addition, samples from subareas where PCBs, munitions-related items, or both had been observed or were suspected were also analyzed for PCBs and chemicals associated with explosives.

Dioxins and furans were not included as analytes during the RI because research (de Voogt and Brinkman, 1989; DeGrandchamp and Barron, 2005) has shown that only trace levels of dioxins and furans are present in the type of PCB found at the FCS (Aroclor 1260) and because areas of burned debris were not collocated with evidence of chlorinated solvent use. The following lines of evidence support the decision not to analyze samples for dioxins and furans:

1. PCB-contaminated soil that may have contained PCB-associated dioxins and furans has been removed from the site
2. Soil samples collected from sidewalls and floors of excavations where burned material was found were analyzed for VOCs and none of the results suggested possible use of chlorinated solvents as an accelerant.
3. IDW wastes (soil cuttings) associated with installation of MW80 and MW81 (located near the former Building 52 foundation) were analyzed for dioxins and furans and only trace levels were detected, at concentrations attributable to typical anthropogenic background sources.

3.2.2 Project Screening Levels

The project screening levels (PSL) are conservative values used to identify COIs and determine the nature and extent of those COIs in soil and groundwater. Although most of the PSLs are derived by applying health-conservative exposure-based assumptions, their use in this report is solely to provide a perspective for identifying the nature and extent of contamination, and they are not intended to infer the existence of unacceptable risk. Rather, the risk assessment conducted as part of this RI provides site-specific estimates of risk intended for management decision making.

The PSLs used for the nature and extent evaluations were based primarily on the 2009 ADEC Method 2 Cleanup Levels, as listed in 18 AAC 75 Tables B1/B2 for soil and Table C for groundwater and adjusted to account for possible cumulative exposure from multiple chemicals.[1] For soil, the PSL consists of the lowest of the adjusted under 40-inch zone-direct contact value and the adjusted under 40-inch zone outdoor inhalation value or background if it is higher than the lowest Method 2-based value. For groundwater, the PSL consists of the adjusted Table C value for drinking water, or background if higher. The residential and tap-water regional screening levels (RSL) listed in the *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites* (EPA, 2009a), were used for analytes without ADEC values.[2] The ADEC values were used preferentially over the RSLs because the ADEC values were calculated using exposure assumptions that are more realistic for the region and its inclement weather. For example, ADEC assumes 270 days of exposure per year; whereas, the RSLs assume 350 days of exposure per year. The PSLs for soil and groundwater are listed in Tables 3-1 and 3-2.

[1] The ADEC Method 2 cleanup levels are based on an excess lifetime cancer risk (ELCR) of 1×10^{-5} and a hazard index (HI) of 1, consequently the ADEC values for direct contact and outdoor inhalation listed in Tables B1/B2 and for groundwater ingestion in Table C were divided by 10 prior to selection of the lowest applicable value.

[2] The residential RSLs for noncarcinogenic chemicals are based on an HI of 1. Therefore, to account for possible cumulative risk associated with multiple chemical exposures, the listed RSLs for non-carcinogens were divided by 10.

3.2.3 Sources of Background Concentrations

The target analyte lists for samples collected in the FCS include many metals that occur naturally in FCS soils and groundwater. For some metals, the background levels are higher than the risk-based values that make up the PSLs. In such instances, EPA and ADEC guidance suggests using representative background values as screening levels (EPA, 1989; ADEC, 2010) for identifying contaminants and assessing potential risk.

The background metals concentrations for arsenic, barium, cadmium, chromium, and lead in soil reported in the 1994 USACE FWA study (USACE, 1994) were used in the PSL selection process for soils. Of these metals, only the arsenic background concentration (8.46 mg/kg) was greater than the selected risk-based level and was, therefore, selected as the PSL.

The background metals concentrations for arsenic, barium, cadmium, chromium, and lead in groundwater reported in the 1994 USACE study were used in the PSL selection process for groundwater. These values have been used in other FWA RI/FS documents and records of decision (ROD), including the OU 5 ROD.

The background values used to develop PSLs are listed under the Background and Source columns in Tables 3-1 and 3-2.

3.2.4 Additional Screening Levels

Screening levels are also used to evaluate soil gas and characterize possible migration of soil contaminants to groundwater. These two analyses are not nature and extent evaluations, per se, but are used to better understand possible cross-media impacts and assist in delineation of soil or groundwater plumes at the FCS. As with the PSLs, these screening levels are based on health-conservative exposure-based assumptions. Their use in this report is solely to provide a perspective for analytical results; they are not intended to infer the existence of unacceptable risk. The risk assessment conducted as part of this RI provides site-specific estimates of risk intended for management decision making.

- **Soil Gas:** The screening levels for evaluating soil gas are the target levels for shallow or subslab soil gas listed in Appendix E of the *Draft Vapor Intrusion Guidance for Contaminated Site (*ADEC, 2009a*)* adjusted by a factor of 1/10 to reflect a cancer risk level of 10^{-6} and HQ of 1.0. These values are listed in Table 3-3.
- **Migration to Groundwater:** The screening levels used to evaluate the potential for soil contaminants to migrate and adversely affect groundwater are the migration to groundwater values listed in the 2009 ADEC Method 2 Cleanup Levels, as listed in 18 AAC 75 Tables B1 and B2. The groundwater protection RSLs (EPA, 2009a) were used for analytes without ADEC values. The migration-to-groundwater screening levels are listed in Table 3-4.

3.2.5 Data Processing

As noted in *Guidelines for Data Reporting, Data Reduction, and Treatment of Non-detect Values* (ADEC, 2008a), multiple results can be reported for the same constituent in the same sample because of multiple analyses by a single method, or analyses of a sample by multiple methods with overlapping target analyte lists; multiple results are also reported for samples when a field duplicate is collected. Multiple results for samples evaluated for the RI were processed or "reduced" prior to evaluation to ensure use of consistent data when making decisions about the nature and extent of contamination and risk assessment. The ADEC guidance was followed to identify the best results for each sample, as follows:

- Reporting of multiple results for the same constituent in the same sample:
  - In the event that more than one contaminant result was reported as a result of multiple analyses by a single method, the highest detected value was used.
  - If more than one result was reported from alternate analytical method(s) for a single contaminant, the highest detected value was used.
  - If results were reported as nondetect (ND) by multiple analyses or methods, the undetected result with the lowest detection limit (DL) was selected for reporting.
- Data reduction from field duplicate samples:
  - The most conservative detectable sample result of the primary and duplicate results was used as the best result
  - If the primary and duplicate results were both reported as ND, the minimum DL was used with the data qualification flag denoting the result as ND (U qualified)
  - If one of the results was reported as ND and the other was a detectable concentration, the detected value was used.

Application of the best result selection process to the RI data set is documented in Appendix G.

3.2.6 Data Usability Evaluations

As indicated in Section 2.3, numerous investigations were conducted at the FCS and a wide variety of sample results were available for possible use in the nature and extent evaluation. The first step in the evaluation process for each medium was a determination of whether data from all of these investigations were appropriate for use in evaluating the nature and extent of contamination. Although target analyte and sample coverage also played a role, the key consideration in determining the usability of the different data sets was whether the MDLs for each study were adequate to detect the target analytes at concentrations consistent with the PSLs; that is, whether the MDL was low enough to conclude that the analyte was not present at levels that might pose potential risk (assuming the conservative exposure scenarios of the PSLs) if an analyte was not detected in any samples.

Data usability was evaluated by investigation and medium. The ex situ soil and waste samples used to provide a rough characterization of contaminant sources (as discussed in Section 4) were not considered in the nature and extent evaluation because samples of ex situ soil and waste removed from the site are not representative of current site conditions.

To accomplish the usability evaluations, data for each investigation and medium were consolidated into summary statistics tables that list the following for each analyte: number of samples analyzed, number of detects and NDs, minimum and maximum detected values, minimum and maximum MDLs for NDs, the PSL, and the number of ND results with MDLs greater than the PSL. These summary tables were then reviewed to identify any analytes that were not detected and consistently had ND MDLs greater than the PSLs. The investigations and analytes with possible data usability issues are listed in Tables 3-5 (soil), 3-6 (groundwater), and 3-7 (soil gas). Full listings of the summary statistics tables for each investigation and medium are provided in Appendix H.

Soil

The RIs and four pre-RIs conducted at the FCS included the collection of soil samples. The information in Table 3-5 indicates that the analytical data for soil from all of the investigations appear to be fully usable in the nature and extent evaluation. Although a few analytes consistently had ND MDLs that exceeded their PSLs, the elevated MDLs occurred in multiple investigations and appear to be more a function of analytical method limitations relative to very low PSLs than an indication of poor data quality. The uncertainty analyses for the nature and extent evaluation (see Section 5) and the risk assessments (see Section 7) discuss how the elevated detection limits for these compounds affect study findings.

Groundwater

As indicated in Table 3-6, the analytical data for groundwater samples collected during investigations that preceded the RI are limited in terms of the number of samples and target analytes. In addition, many of the target analytes had ND MDLs considerably above the PSLs. The fall 2007, spring 2008, fall 2008, spring 2009, fall 2009 and supplemental 1,2,3-trichloropropane and TCE investigation groundwater data sets provide better coverage in terms of sample locations and target analytes and, for the most part, appear to have MDLs that are consistent with the PSLs. Therefore, only analytical data associated with the past five groundwater monitoring events and the supplemental groundwater studies were used in the nature and extent evaluation for groundwater. While the ND MDLs for certain analytes in these data sets also contain a high number of PSL exceedances, the elevated MDLs occurred in multiple sampling and appear to be more a function of analytical method limitations relative to very low PSLs than an indication of poor data quality. The uncertainty analyses for the nature and extent evaluation (see Section 5) and the risk assessments (see Section 7) discuss how the elevated detection limits for these compounds affect study findings.

Soil Gas

The soil gas data set consists of two types of samples collected from the FCS, soil gas samples obtained from boreholes advanced in open areas and subslab soil gas samples obtained from portals drilled through the foundations of the residences. Indoor air samples collected from the residences and ambient air samples collected around the FCS are not considered soil gas, and were not evaluated for usability. The analytical data associated with the subslab soil gas and vadose zone sampling events conducted in fall 2007, and subslab soil gas sampling conducted in fall 2008, December 2008, and August 2009 were considered in the data usability evaluation for soil gas.

As indicated in Table 3-7, the MDLs for 25 VOCs were considerably higher than the PSLs during the fall 2007 sampling event. Further research conducted in 2008 determined that the elevated MDLs were a result of the unanticipated presence of high levels of Freon-related compounds in the soil gas. The Freon-related compounds could have been related to foam board and spray insulation construction of the housing development and were not considered target analytes for the RI. Special analytical methods were used to isolate the Freon-related compounds during subsequent rounds of sampling, and the MDLs for the other sampling events are more in line with the PSLs.

The fall 2008 soil gas sampling event was limited to 10 locations and was only intended to be used in the initial attenuation factor analysis. The nature and extent evaluation incorporated results of the more comprehensive December 2008 and August 2009 sampling events.

Because of these issues, only detected results from vadose zone sampling during the fall 2007 event and most analytical data associated with the December 2008 and August 2009 sampling events were usable for the soil gas evaluation. The exception to the usability of the December 2008 sampling event is the detection of 1,2-dibromo-3-chloropropane (DBCP) in a subslab sample collected from Building 13. As indicated in Section 2.3.3, the detection of this chemical (a soil fumigant and nematocide, formerly used in tropical agriculture) was unanticipated. The analytical data for the sample were reviewed and several discrepancies in laboratory protocols were identified, making detection of the chemical suspect. To confirm that DBCP was not present in soil gas beneath the building, both subslab soil ports and the indoor air in Building 13 were resampled in March 2009. DBCP was not detected in any samples. Consequently, the December 2008 results for DBCP in this sample were not considered usable and were not included in the soil gas evaluation or in the risk assessment.

3.2.7 Data Used in RI Evaluations

This section describes the sources of the data used to evaluate the nature and extent of contamination. In most cases, the same data sources are used in the risk assessments, although there are exceptions because of sample depth (for example, soil samples obtained at depths greater than 15 feet bgs are excluded from the human health risk assessment) or media type (for example, indoor and ambient air samples collected during soil gas sampling events are excluded from the soil gas evaluation).

Source Characterization

As indicated in Sections 2.3 and 3.1, a variety of buried metal and debris, including empty drums, some drums with contents, and munitions-related items were found at the surface and in the subsurface at the FCS. The debris, along with associated contaminated soil, tended to be concentrated in former low-lying areas (for example, the former channel of Hoppe's Slough) and in pits that were filled and covered before the FCS was developed. These source areas appear to be related to historical uses of the area for salvage, housing, and offices. Materials and chemicals placed in these former disposal areas are assumed to be the primary sources of contaminated soil and groundwater at the FCS. The possible fire training area in the northern portion of the salvage yard near Buildings 21 and 23 did not appear to be a source of contaminants since only limited evidence of burning was found in nearby excavations and soil and groundwater beneath the area were not affected by petroleum, solvents, or other chemicals typically associated with fire training areas.

Figure 3-1 shows the locations and extents of excavations used to investigate and remove possible contaminant sources at the FCS. One thousand fifty-three drums (mostly empty and crushed) and approximately 5,000 yd^3 of debris, munitions-related items, and contaminated soil were removed from the surface and subsurface at the FCS during remedial investigation activities in 2007, 2008, and 2009. Numerous test pits and exploratory excavations at the FCS encountered buried metal, but soil and groundwater contamination only coincided with extensive and concentrated deposits of materials. Debris and soil were also removed during the course of subdivision construction. Although some debris could remain beneath buildings (as discussed in Section 4), the majority of potential contaminant source materials, including the drums beneath Building 49, have been removed from the FCS.

The qualitative historical contaminant source evaluation used both pre-RI and RI data from waste samples and excavated (or otherwise removed) soils. The soil and waste samples used in the source characterization evaluation were obtained from soil piles left at the site and adjacent areas following construction of the Taku Gardens family housing development, from waste and soil samples obtained during the drum and debris investigations and PCB removal excavations, and samples of soil from other areas known to have been graded or reconfigured. The source assessment is considered qualitative because most of the pre-RI samples were not collected for the purpose of source area identification and characterizations and were missing or had inaccurate sample location and depth information.

The source characterization group includes 57 samples taken from soil piles, over 100 soil samples taken from PCB sites and drum and debris investigations, 66 samples from material identified as waste, and over 900 surface soil samples taken from undefined areas prior to development of the FCS. While most of the samples obtained in undefined areas were analyzed only for PCBs, the other sample types were analyzed for a broad list of target analytes that consisted of VOCs, SVOCs, PAHs, pesticides, and metals. The locations of samples with recorded coordinates are shown on Figure 3-3 (many historical samples labeled as waste or ex situ soil did not have recorded coordinates) and listed in Appendix I (see Table A).

Surface Soil Nature and Extent Evaluations

All of the samples used in the nature and extent evaluation for surface soil were collected within the upper 2 feet of soil. This includes surface samples collected specifically for surface soil characterization, as well as samples from between the ground surface and 2 feet bgs on excavation sidewalls and within boreholes. Samples not considered representative of current in situ soil conditions (e.g., samples collected prior to construction of the Taku Gardens family housing development or samples collected prior to excavation of contaminated soil) were omitted from the data set, as were the MI samples collected from the soil piles (the soil pile sample results are included in the source characterization group). MI samples collected from the sound berms in 2007 are evaluated separately from the discrete surface soil samples. Depending on the analyte, as many as 220 samples made up the surface soil sample group used in the nature and extent evaluation. Most of these samples were analyzed for VOCs, SVOCs, PAHs, PCBs, pesticides, and metals. Lesser quantities of samples were analyzed for explosives and herbicides. TIC analysis was performed on 25 soil samples. The samples used in the evaluation are shown on Figure 3-4 and are listed in Appendix I (see Table B). The same samples were used in the migration to groundwater evaluation.

Subsurface Soil Nature and Extent Evaluations

Samples used in the nature and extent evaluation for subsurface soil were collected at depths greater than 2 feet bgs. These samples include those collected from boreholes advanced for monitoring well installation, and from the floors and sidewalls of excavations. Samples not considered representative of current in situ soil conditions (i.e., collected before excavation of contaminated soil) were omitted from the data set. However, samples located within excavations, but from intervals beneath the maximum depth of excavation were included in the data set. Depending on the analyte, between 368 and 651 samples made up the subsurface soil sample group used in the nature and extent evaluation, and most samples were analyzed for the broader target analyte list. TIC analysis was performed on 39 soil samples, and although dioxins and furans were not considered target analytes for the RI, one subsurface soil sample from the 2006 PSE II was analyzed for these compounds. The locations for samples used in the evaluation are shown on Figure 3-5. (Multiple depth intervals were sampled at many of the locations.) Sample information is listed in Appendix I (see Table C). The same samples were used in the migration to groundwater evaluation.

Groundwater Nature and Extent Evaluation

The samples used in the nature and extent evaluation for groundwater were collected at monitoring wells distributed throughout the FCS, at the water supply wells in Building 3559, and from borings advanced north of the FCS during the 2009 TCE investigation. Samples collected during the five most recent sampling events (fall 2007, spring 2008, fall 2008, spring 2009, and fall 2009) and from the 2009 TCE and 1,2,3-trichloropropane investigations were considered in the evaluation. The 264 samples were analyzed for the broad list of target analytical suites, including VOCs, SVOCs, PAHs, PCBs, pesticides, DRO/RRO, GRO, metals, and herbicides. Groundwater samples from wells located in areas where munitions-related items had been found were also analyzed for explosives using analytical methods that are not affected by the presence of petroleum. TIC analysis was conducted on 13 of the groundwater samples. The locations for samples used in the evaluation are shown on Figure 3-6. Sample information is listed in Appendix I (see Table D).

Soil Gas Nature and Extent Evaluation

The samples used in the soil gas evaluation were collected from vadose zone (upper 6 feet) soil borings in open areas throughout the FCS, and from subslab soil gas ports installed in garages of each building. All detected results for the vadose zone soil gas samples from fall 2007 were considered in the general soil gas evaluation. All results for the subslab soil gas samples from the December 2008 (with the exception of the December 2008 detection of DBCP, as discussed in Sections 2.3.3 and 3.2.5) and August 2009 events were considered in the subslab soil gas evaluation. Both types of soil gas samples were analyzed for VOCs using EPA Method TO 15. The locations for samples used in the evaluation are shown on Figure 3-7. Sample information is listed in Appendix I (see Table E).

3.2.8 Identification and Distribution Analysis for Chemicals of Interest

The COI identification process for the nature and extent evaluation involved simple comparisons of sample results for all media of interest with their respective PSLs. Any target analyte with one or more exceedances of a PSL or soil gas screening level was identified as a possible COI for that medium.

The list of samples and results with exceedances was then reviewed to identify any possible issues with the usability or representativeness of the result (for example, whether the location was resampled later with a different result). If no such issues were identified, the magnitudes of exceedance for each sample were calculated by dividing the detected result by the PSL. The results for each COI or group of COIs were mapped, using different colors to indicate the magnitude of PSL exceedance at each sample location. The following color scheme was applied for mapping each COI or COI group:

- **White:** COI not detected or all detected results less than the PSL
- **Green:** one or more detected results greater than 1 and less than or equal to 10 times the PSL
- **Yellow:** one or more detected result greater than 10 and less than or equal to 100 times the PSL
- **Red:** one or more detected result greater than 100 times the PSL

If multiple COIs at a location exceeded PSLs, the COI with the highest magnitude result determined the color code for the location. Similarly, if more than one set of sample results for a location (such as monitoring wells with multiple sample results) exceeded a PSL, the highest magnitude result determined the color code for the location. Labels were added to indicate the analytes, sample depths (or sample dates), and concentrations reported for each analyte that exceeded a PSL.

The resulting maps were then reviewed to identify any patterns in COI distribution that could indicate potential sources, plumes, or other areas of interest. These maps and the results of the nature and extent evaluation are presented in Section 5.

3.3 Human Health Risk Assessment Approach

The procedures and assumptions used for assessing human and ecological risk are as described in the *Human Health and Ecological Risk Assessment Work Plan, FWA 102 Former Communications Site Fort Wainwright, Alaska* (CH2M HILL, 2007f) and are in accordance with both EPA and ADEC guidance on risk assessment (ADEC, 2009b). The HHRA evaluates the following exposure scenarios for the FCS:

- Future maintenance worker scenario
- Future excavation worker scenario
- Future recreational/site visitor scenario
- Reasonably anticipated future residential scenario
- Hypothetical unrestricted exposure scenario

The cancer and noncancer risk estimates for soil, subslab soil gas, and groundwater, under future conditions, are summarized by exposure scenario. The COPCs identified for each medium include all detected chemicals with available toxicity factors (unless demonstrated to be less than natural background, such as arsenic in soil and several metals in groundwater). For each potentially exposed population, risk estimates are provided for individual exposure routes, as well as cumulative risks across all exposure routes. For the residential exposure scenario, for which exposure to more than one environmental medium can occur, multimedia risk estimates are also provided.

3.4 Ecological Risk Assessment Approach

The ERA was conducted in accordance with ADEC guidance (2009c) and EPA guidance (1992, 1997a, 1998). Both ADEC and EPA recommend using a phased approach. Each phase is more detailed and focused than the preceding one. Use of this approach focuses the ERA on the chemicals of potential ecological concern (COPEC), receptors, and areas where the greatest potential for ecological exposure would be expected. The risk to offsite terrestrial wildlife and offsite aquatic resources potentially exposed to the COPECs occurring in the drainage swale and groundwater is considered (see Section 7.6).

TABLE 3-1
Project Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Direct	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Outdoor Inhl	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Ingestion	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Inhalation	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Soil PSL	Source
VOC	630-20-6	1,1,1,2-Tetrachloroethane	mg/kg	--	--	--	--	1.9	--	1.9	Res RSL
VOC	71-55-6	1,1,1-Trichloroethane	mg/kg	2030	36	--	--	--	--	36	1/10th ADEC outdoor inhl
VOC	79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	4.2	0.55	--	--	--	--	0.55	1/10th ADEC outdoor inhl
VOC	79-00-5	1,1,2-Trichloroethane	mg/kg	15	1.1	--	--	--	--	1.1	1/10th ADEC outdoor inhl
VOC	75-34-3	1,1-Dichloroethane	mg/kg	2030	90	--	--	--	--	90	1/10th ADEC outdoor inhl
VOC	75-35-4	1,1-Dichloroethene	mg/kg	1.4	0.085	--	--	--	--	0.085	1/10th ADEC outdoor inhl
VOC	87-61-6	1,2,3-Trichlorobenzene	mg/kg	--	--	--	--	4.9	--	4.9	1/10 Res RSL
VOC	96-18-4	1,2,3-Trichloropropane	mg/kg	0.12	0.017	--	--	--	--	0.017	1/10th ADEC outdoor inhl
VOC	120-82-1	1,2,4-Trichlorobenzene	mg/kg	100	4.1	--	--	--	--	4.1	1/10th ADEC outdoor inhl
VOC	95-63-6	1,2,4-Trimethylbenzene	mg/kg	510	4.9	--	--	--	--	4.9	1/10th ADEC outdoor inhl
VOC	96-12-8	1,2-Dibromo-3-chloropropane	mg/kg	--	--	--	--	0.0054	--	0.0054	Res RSL
VOC	106-93-4	1,2-Dibromoethane	mg/kg	0.42	0.06	--	--	--	--	0.06	1/10th ADEC outdoor inhl
VOC	95-50-1	1,2-Dichlorobenzene	mg/kg	910	4.5	--	--	--	--	4.5	1/10th ADEC outdoor inhl
VOC	107-06-2	1,2-Dichloroethane	mg/kg	9.1	0.48	--	--	--	--	0.48	1/10th ADEC outdoor inhl
VOC	78-87-5	1,2-Dichloropropane	mg/kg	12	0.53	--	--	--	--	0.53	1/10th ADEC outdoor inhl
VOC	108-67-8	1,3,5-Trimethylbenzene	mg/kg	510	4.2	--	--	--	--	4.2	1/10th ADEC outdoor inhl
VOC	541-73-1	1,3-Dichlorobenzene	mg/kg	910	6.9	--	--	--	--	6.9	1/10th ADEC outdoor inhl
VOC	142-28-9	1,3-Dichloropropane	mg/kg	--	--	--	--	160	--	160	1/10 Res RSL
VOC	106-46-7	1,4-Dichlorobenzene	mg/kg	35	3	--	--	--	--	3	1/10th ADEC outdoor inhl
VOC	78-93-3	2-Butanone	mg/kg	6080	2330	--	--	--	--	2330	1/10th ADEC outdoor inhl
VOC	95-49-8	2-Chlorotoluene	mg/kg	--	--	--	--	160	--	160	1/10 Res RSL
VOC	591-78-6	2-Hexanone	mg/kg	--	--	--	--	21	--	21	1/10 Res RSL
VOC	78-83-1	2-Methyl-1-propanol	mg/kg	--	--	--	--	2300	--	2300	1/10 Res RSL
VOC	106-43-4	4-Chlorotoluene	mg/kg	--	--	--	--	550	--	550	1/10 Res RSL
VOC	108-10-1	4-Methyl-2-pentanone	mg/kg	810	210	--	--	--	--	210	1/10th ADEC outdoor inhl
VOC	67-64-1	Acetone	mg/kg	9130	6860	--	--	--	--	6860	1/10th ADEC outdoor inhl
VOC	71-43-2	Benzene	mg/kg	15	1.1	--	--	--	--	1.1	1/10th ADEC outdoor inhl
VOC	108-86-1	Bromobenzene	mg/kg	--	--	--	--	30	--	30	1/10 Res RSL
VOC	75-27-4	Bromodichloromethane	mg/kg	13	1	--	--	--	--	1	1/10th ADEC outdoor inhl
VOC	75-25-2	Bromoform	mg/kg	110	42	--	--	--	--	42	1/10th ADEC outdoor inhl
VOC	74-83-9	Bromomethane	mg/kg	14	1.4	--	--	--	--	1.4	1/10th ADEC outdoor inhl
VOC	75-15-0	Carbon Disulfide	mg/kg	480	25	--	--	--	--	25	1/10th ADEC outdoor inhl
VOC	56-23-5	Carbon tetrachloride	mg/kg	6.4	0.31	--	--	--	--	0.31	1/10th ADEC outdoor inhl
VOC	108-90-7	Chlorobenzene	mg/kg	200	20	--	--	--	--	20	1/10th ADEC outdoor inhl
VOC	75-00-3	Chloroethane	mg/kg	290	2.3	--	--	--	--	2.3	1/10th ADEC outdoor inhl
VOC	67-66-3	Chloroform	mg/kg	100	0.32	--	--	--	--	0.32	1/10th ADEC outdoor inhl
VOC	74-87-3	Chloromethane	mg/kg	64	2.5	--	--	--	--	2.5	1/10th ADEC outdoor inhl
VOC	156-59-2	cis-1,2-Dichloroethene	mg/kg	100	13	--	--	--	--	13	1/10th ADEC outdoor inhl
VOC	124-48-1	Dibromochloromethane	mg/kg	9.9	1.4	--	--	--	--	1.4	1/10th ADEC outdoor inhl
VOC	74-95-3	Dibromomethane	mg/kg	100	37	--	--	--	--	37	1/10th ADEC outdoor inhl
VOC	75-71-8	Dichlorodifluoromethane	mg/kg	2030	38	--	--	--	--	38	1/10th ADEC outdoor inhl
VOC	100-41-4	Ethylbenzene	mg/kg	1010	11	--	--	--	--	11	1/10th ADEC outdoor inhl
VOC	110-54-3	Hexane	mg/kg	--	--	--	--	57	--	57	1/10th RSL for N, hexane
VOC	87-68-3	Hexachlorobutadiene	mg/kg	1.3	0.38	--	--	--	--	0.38	1/10th ADEC outdoor inhl
VOC	98-82-8	Isopropylbenzene	mg/kg	1010	6.2	--	--	--	--	6.2	1/10th ADEC outdoor inhl
VOC	108-38-3/1	m, p-xylene	mg/kg	--	--	--	--	340		340	1/10 Res RSL
VOC	75-09-2	Methylene chloride	mg/kg	110	16	--	--	--	--	16	1/10th ADEC outdoor inhl
VOC	1634-04-4	Methyl-tert-butyl ether (MTBE)	mg/kg	460	29	--	--	--	--	29	1/10th ADEC outdoor inhl
VOC	104-51-8	n-Butylbenzene	mg/kg	100	4.2	--	--	--	--	4.2	1/10th ADEC outdoor inhl
VOC	103-65-1	n-Propylbenzene	mg/kg	100	4.2	--	--	--	--	4.2	1/10th ADEC outdoor inhl
VOC	95-47-6	o-Xylene	mg/kg	--	--	--	--	380	--	380	1/10 Res RSL
VOC	135-98-8	sec-Butylbenzene	mg/kg	100	4.1	--	--	--	--	4.1	1/10th ADEC outdoor inhl
VOC	100-42-5	Styrene	mg/kg	2030	20	--	--	--	--	20	1/10th ADEC outdoor inhl
VOC	98-06-6	tert-Butylbenzene	mg/kg	100	7	--	--	--	--	7	1/10th ADEC outdoor inhl
VOC	127-18-4	Tetrachloroethene (PCE)	mg/kg	1.5	1	--	--	--	--	1	1/10th ADEC outdoor inhl
VOC	108-88-3	Toluene	mg/kg	810	22	--	--	--	--	22	1/10th ADEC outdoor inhl
VOC	156-60-5	trans-1,2-Dichloroethene	mg/kg	200	16	--	--	--	--	16	1/10th ADEC outdoor inhl
VOC	79-01-6	Trichloroethene (TCE)	mg/kg	2.1	0.057	--	--	--	--	0.057	1/10th ADEC outdoor inhl
VOC	75-69-4	Trichlorofluoromethane	mg/kg	3040	99	--	--	--	--	99	1/10th ADEC outdoor inhl
VOC	76-13-1	Trichlorotrifluoroethane (Freon 113)	mg/kg	>100000	75					75	1/10th ADEC outdoor inhl
VOC	108-05-4	Vinyl Acetate	mg/kg	10100	150	--	--	--	--	150	1/10th ADEC outdoor inhl
VOC	75-01-4	Vinyl chloride	mg/kg	0.55	0.43	--	--	--	--	0.43	1/10th ADEC outdoor inhl
VOC	1330-20-7	Xylenes, Total	mg/kg	2030	6.3	--	--	--	--	6.3	1/10th ADEC outdoor inhl
TPH	PHCD	DRO	mg/kg	--	--	1025	1250	--	--	1025	1/10th ADEC - Ingestion
TPH	PHCG	GRO	mg/kg	--	--	140	140	--	--	140	1/10th ADEC - Ingestion
TPH	TPH-Oil	RRO	mg/kg	--	--	1000	2200	--	--	1000	1/10th ADEC - Ingestion
SVOC	122-66-7	1,2-Diphenylhydrazine	mg/kg	--	--	--	--	0.61	--	0.61	Res RSL
SVOC	95-95-4	2,4,5-Trichlorophenol	mg/kg	650	--	--	--	--	--	650	1/10th ADEC - Direct Contact
SVOC	88-06-2	2,4,6-Trichlorophenol	mg/kg	46	410	--	--	--	--	46	1/10th ADEC - Direct Contact
SVOC	120-83-2	2,4-Dichlorophenol	mg/kg	23	--	--	--	--	--	23	1/10th ADEC - Direct Contact
SVOC	105-67-9	2,4-Dimethylphenol	mg/kg	130	--	--	--	--	--	130	1/10th ADEC - Direct Contact
SVOC	51-28-5	2,4-Dinitrophenol	mg/kg	16	--	--	--	--	--	16	1/10th ADEC - Direct Contact
SVOC	91-58-7	2-Chloronaphthalene	mg/kg	470	--	--	--	--	--	470	1/10th ADEC - Direct Contact

TABLE 3-1
Project Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Direct	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Outdoor Inhl	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Ingestion	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Inhalation	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Soil PSL	Source
SVOC	95-57-8	2-Chlorophenol	mg/kg	51	250	--	--	--	--	51	1/10th ADEC - Direct Contact
SVOC	534-52-1	2-Methyl-4,6-dinitrophenol	mg/kg	--	--	--	--	0.49	--	0.61	1/10 Res RSL
SVOC	95-48-7	2-Methylphenol (o-Cresol)	mg/kg	320	--	--	--	--	--	320	1/10th ADEC - Direct Contact
SVOC	88-74-4	2-Nitroaniline	mg/kg	--	--	--	--	61	--	61	1/10 Res RSL
SVOC	91-94-1	3,3'-Dichlorobenzidine	mg/kg	1.1	--	--	--	--	--	1.1	1/10th ADEC - Direct Contact
SVOC	108-39-4/106	3&4-Methylphenol	mg/kg	--	35	--	--	--	--	35	1/10th ADEC - Direct Contact, p-cresol
SVOC	59-50-7	4-Chloro-3-methylphenol	mg/kg	--	--	--	--	610	--	610	1/10 Res RSL
SVOC	59-50-7	4-Chloro-3-methylphenol	mg/kg	--	--	--	--	610	--	610	1/10 Res RSL
SVOC	106-47-8	4-Chloroaniline	mg/kg	9	--	--	--	--	--	9	1/10th ADEC - Direct Contact
SVOC	100-01-6	4-Nitroaniline	mg/kg	--	--	--	--	24	--	24	Res RSL
SVOC	103-33-3	Azobenzene	mg/kg	--	--	--	--	5.1	--	5.1	Res RSL
SVOC	65-85-0	Benzoic acid	mg/kg	31700	--	--	--	--	--	31700	1/10th ADEC - Direct Contact
SVOC	100-51-6	Benzyl alcohol	mg/kg	--	--	--	--	610	--	610	1/10 Res RSL
SVOC	85-68-7	Benzyl butyl phthalate	mg/kg	290	--	--	--	--	--	290	1/10th ADEC - Direct Contact
SVOC	111-91-1	bis-(2-Chloroethoxy)methane	mg/kg	--	--	--	--	18	--	18	1/10 Res RSL
SVOC	111-44-4	bis-(2-Chloroethyl)ether	mg/kg	0.75	0.33	--	--	--	--	0.33	1/10th ADEC outdoor inhl
SVOC	108-60-1	bis(2-Chloroisopropyl)ether	mg/kg	--	--	--	--	4.6	--	4.6	Res RSL
SVOC	117-81-7	bis-(2-Ethylhexyl)phthalate	mg/kg	22	--	--	--	--	--	22	1/10th ADEC - Direct Contact
SVOC	86-74-8	Carbazole	mg/kg	29	--	--	--	--	--	29	1/10th ADEC - Direct Contact
SVOC	132-64-9	Dibenzofuran	mg/kg	20	--	--	--	--	--	20	1/10th ADEC - Direct Contact
SVOC	84-66-2	Diethyl phthalate	mg/kg	6190	--	--	--	--	--	6190	1/10th ADEC - Direct Contact
SVOC	131-11-3	Dimethyl phthalate	mg/kg	77300	--	--	--	--	--	77300	1/10th ADEC - Direct Contact
SVOC	84-74-2	Di-n-butyl phthalate	mg/kg	790	--	--	--	--	--	790	1/10th ADEC - Direct Contact
SVOC	117-84-0	Di-n-octyl phthalate	mg/kg	310	--	--	--	--	--	310	1/10th ADEC - Direct Contact
SVOC	118-74-1	Hexachlorobenzene	mg/kg	0.32	0.15	--	--	--	--	0.15	1/10th ADEC outdoor inhl
SVOC	77-47-4	Hexachlorocyclopentadiene	mg/kg	39	0.2	--	--	--	--	0.2	1/10th ADEC outdoor inhl
SVOC	67-72-1	Hexachloroethane	mg/kg	6.5	17	--	--	--	--	6.5	1/10th ADEC - Direct Contact
SVOC	78-59-1	Isophorone	mg/kg	530	--	--	--	--	--	530	1/10th ADEC - Direct Contact
SVOC	62-75-9	n-Nitrosodimethylamine	mg/kg	0.016	0.019	--	--	--	--	0.016	1/10th ADEC - Direct Contact
SVOC	621-64-7	n-Nitrosodi-n-propylamine	mg/kg	0.052	--	--	--	--	--	0.052	1/10th ADEC - Direct Contact
SVOC	86-30-6	n-Nitrosodiphenylamine	mg/kg	75	--	--	--	--	--	75	1/10th ADEC - Direct Contact
SVOC	87-86-5	Pentachlorophenol	mg/kg	3.9	--	--	--	--	--	3.9	1/10th ADEC - Direct Contact
SVOC	108-95-2	Phenol	mg/kg	2320	--	--	--	--	--	2320	1/10th ADEC - Direct Contact
PESTICIDE	72-54-8	4,4'-DDD	mg/kg	3	--	--	--	--	--	3	1/10th ADEC - Direct Contact
PESTICIDE	72-55-9	4,4'-DDE	mg/kg	2.1	--	--	--	--	--	2.1	1/10th ADEC - Direct Contact
PESTICIDE	50-29-3	4,4'-DDT	mg/kg	2.1	--	--	--	--	--	2.1	1/10th ADEC - Direct Contact
PESTICIDE	309-00-2	Aldrin	mg/kg	0.03	--	--	--	--	--	0.03	1/10th ADEC - Direct Contact
PESTICIDE	319-84-6	alpha-BHC	mg/kg	0.12	--	--	--	--	--	0.12	1/10th ADEC - Direct Contact
PESTICIDE	319-85-7	beta-BHC	mg/kg	0.4	--	--	--	--	--	0.4	1/10th ADEC - Direct Contact
PESTICIDE	60-57-1	Dieldrin	mg/kg	0.032	--	--	--	--	--	0.032	1/10th ADEC - Direct Contact
PESTICIDE	72-20-8	Endrin	mg/kg	0.2	--	--	--	--	--	0.2	1/10th ADEC - Direct Contact
PESTICIDE	58-89-9	gamma-BHC (Lindane)	mg/kg	0.56	--	--	--	--	--	0.56	1/10th ADEC - Direct Contact
PESTICIDE	12789-03-6	gamma-Chlordane	mg/kg	--	--	--	--	1.6	--	1.6	Res RSL
PESTICIDE	76-44-8	Heptachlor	mg/kg	0.13	--	--	--	--	--	0.13	1/10th ADEC - Direct Contact
PESTICIDE	1024-57-3	Heptachlor epoxide	mg/kg	0.063	--	--	--	--	--	0.063	1/10th ADEC - Direct Contact
PESTICIDE	72-43-5	Methoxychlor	mg/kg	32	--	--	--	--	--	32	1/10th ADEC - Direct Contact
PESTICIDE	8001-35-2	Toxaphene	mg/kg	0.75	--	--	--	--	--	0.75	1/10th ADEC - Direct Contact
PCBs	12674-11-2	PCB-1016 (Aroclor 1016)	mg/kg	--	--	--	--	3.9	--	1	Site specific
PCBs	11104-28-2	PCB-1221 (Aroclor 1221)	mg/kg	--	--	--	--	0.14	--	1	Site specific
PCBs	11141-16-5	PCB-1232 (Aroclor 1232)	mg/kg	--	--	--	--	0.14	--	1	Site specific
PCBs	53469-21-9	PCB-1242 (Aroclor 1242)	mg/kg	--	--	--	--	0.22	--	1	Site specific
PCBs	12672-29-6	PCB-1248 (Aroclor 1248)	mg/kg	--	--	--	--	0.22	--	1	Site specific
PCBs	11097-69-1	PCB-1254 (Aroclor 1254)	mg/kg	--	--	--	--	0.22	--	1	Site specific
PCBs	11096-82-5	PCB-1260 (Aroclor 1260)	mg/kg	--	--	--	--	0.22	--	1	Site specific
PAH	91-57-6	2-Methylnaphthalene	mg/kg	28	75	--	--	--	--	28	1/10th ADEC - Direct Contact
PAH	83-32-9	Acenaphthene	mg/kg	280	--	--	--	--	--	280	1/10th ADEC - Direct Contact
PAH	208-96-8	Acenaphthylene	mg/kg	280	--	--	--	--	--	280	1/10th ADEC - Direct Contact
PAH	120-12-7	Anthracene	mg/kg	2060	--	--	--	--	--	2060	1/10th ADEC - Direct Contact
PAH	56-55-3	Benzo(a)anthracene	mg/kg	0.49	--	--	--	--	--	0.49	1/10th ADEC - Direct Contact
PAH	50-32-8	Benzo(a)pyrene	mg/kg	0.049	--	--	--	--	--	0.049	1/10th ADEC - Direct Contact
PAH	205-99-2	Benzo(b)fluoranthene	mg/kg	0.49	--	--	--	--	--	0.49	1/10th ADEC - Direct Contact
PAH	191-24-2	Benzo(g,h,i)perylene	mg/kg	140	--	--	--	--	--	140	1/10th ADEC - Direct Contact
PAH	207-08-9	Benzo(k)fluoranthene	mg/kg	4.9	--	--	--	--	--	4.9	1/10th ADEC - Direct Contact
PAH	218-01-9	Chrysene	mg/kg	49	--	--	--	--	--	49	1/10th ADEC - Direct Contact
PAH	53-70-3	Dibenzo(a,h)anthracene	mg/kg	0.049	--	--	--	--	--	0.049	1/10th ADEC - Direct Contact
PAH	206-44-0	Fluoranthene	mg/kg	190	--	--	--	--	--	190	1/10th ADEC - Direct Contact
PAH	86-73-7	Fluorene	mg/kg	230	--	--	--	--	--	230	1/10th ADEC - Direct Contact
PAH	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	0.49	--	--	--	--	--	0.49	1/10th ADEC - Direct Contact
PAH	91-20-3	Naphthalene	mg/kg	140	2.8	--	--	--	--	2.8	1/10th ADEC outdoor inhl
PAH	85-01-8	Phenanthrene	mg/kg	2060	--	--	--	--	--	2060	1/10th ADEC - Direct Contact
PAH	129-00-0	Pyrene	mg/kg	140	--	--	--	--	--	140	1/10th ADEC - Direct Contact
OTHER	109-66-0	Pentane	mg/kg	--	--	--	--	87	--	87	1/10 Res RSL
OTHER	123-38-6	Propanal	mg/kg	--	--	--	--	8	--	8	1/10 Res RSL

TABLE 3-1
Project Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Direct	1/10th 2009 ADEC Table B1 Method 2 - Under 40 inch Zone - Outdoor Inhl	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Ingestion	1/10th 2009 ADEC Table B2 Method 2 Petroleum Hydrocarbon - Under 40 inch Zone - Inhalation	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Soil PSL	Source
METALS	7429-90-5	Aluminum	mg/kg	--	--	--	--	7700	--	7700	1/10 Res RSL
METALS	7440-36-0	Antimony	mg/kg	4.1	--	--	--	--	--	4.1	1/10th ADEC - Direct Contact
METALS	7440-38-2	Arsenic	mg/kg	0.45	--	--	--	--	8.46	8.46	FT WW Background
METALS	7440-39-3	Barium	mg/kg	2030	--	--	--	--	85.2	2030	1/10th ADEC - Direct Contact
METALS	7440-41-7	Beryllium	mg/kg	20	--	--	--	--	--	20	1/10th ADEC - Direct Contact
METALS	7440-42-8	Boron	mg/kg	--	--	--	--	1600	--	1600	1/10 Res RSL
METALS	7440-43-9	Cadmium	mg/kg	7.9	--	--	--	--	0.58	7.9	1/10th ADEC - Direct Contact
METALS	7440-47-3	Chromium	mg/kg	30	--	--	--	--	14.62	30	1/10th ADEC - Direct Contact
METALS	7440-48-4	Cobalt	mg/kg	--	--	--	--	2.3	--	2.3	1/10 Res RSL
METALS	7440-50-8	Copper	mg/kg	410	--	--	--	--	--	410	1/10th ADEC - Direct Contact
METALS	7439-89-6	Iron	mg/kg	--	--	--	--	5500	--	5500	1/10 Res RSL
METALS	7439-92-1	Lead	mg/kg	40	--	--	--	--	11.44	40	1/10th ADEC - Direct Contact
METALS	7439-96-5	Manganese	mg/kg	--	--	--	--	180	--	180	1/10 Res RSL
METALS	7439-97-6	Mercury	mg/kg	3	1.8	--	--	--	--	1.8	1/10th ADEC outdoor inhl
METALS	7439-98-7	Molybdenum	mg/kg	--	--	--	--	39	--	39	1/10 Res RSL
METALS	7440-02-0	Nickel	mg/kg	200	--	--	--	--	--	200	1/10th ADEC - Direct Contact
METALS	7782-49-2	Selenium	mg/kg	51	--	--	--	--	--	51	1/10th ADEC - Direct Contact
METALS	7440-22-4	Silver	mg/kg	51	--	--	--	--	--	51	1/10th ADEC - Direct Contact
METALS	7440-24-6	Strontium	mg/kg	--	--	--	--	4700	--	4700	1/10 Res RSL
METALS	7440-28-0	Thallium	mg/kg	0.81	--	--	--	--	--	0.81	1/10th ADEC - Direct Contact
METALS	7440-62-2	Vanadium	mg/kg	71	--	--	--	--	--	71	1/10th ADEC - Direct Contact
METALS	7440-66-6	Zinc	mg/kg	3040	--	--	--	--	--	3040	1/10th ADEC - Direct Contact
HERBICIDE	93-76-5	2,4,5-T	mg/kg	--	--	--	--	61	--	61	1/10 Res RSL
HERBICIDE	93-72-1	2,4,5-TP (Silvex)	mg/kg	52	--	--	--	--	--	52	1/10th ADEC - Direct Contact
HERBICIDE	94-75-7	2,4-D	mg/kg	86	--	--	--	--	--	86	1/10th ADEC - Direct Contact
HERBICIDE	94-82-6	2,4-DB	mg/kg	--	--	--	--	49	--	49	1/10 Res RSL
HERBICIDE	75-99-0	Dalapon	mg/kg	--	--	--	--	180	--	180	1/10 Res RSL
HERBICIDE	1918-00-9	Dicamba	mg/kg	--	--	--	--	180	--	180	1/10 Res RSL
HERBICIDE	88-85-7	Dinoseb	mg/kg	--	--	--	--	6.1	--	6.1	1/10 Res RSL
HERBICIDE	94-74-6	MCPA (2-Methyl-4-chlorophenoxy acetic	mg/kg	--	--	--	--	3.1	--	3.1	1/10 Res RSL
HERBICIDE	93-65-2	MCPP (2-(2-methyl-4-chlorophenoxy)	mg/kg	--	--	--	--	6.1	--	6.1	1/10 Res RSL
GEN CHEM	16984-48-8	Fluoride	mg/kg	--	--	--	--	310	--	310	1/10 Res RSL
EXPLOSIVE	99-35-4	1,3,5-Trinitrobenzene	mg/kg	280	--	--	--	--	--	280	1/10th ADEC - Direct Contact
EXPLOSIVE	99-65-0	1,3-Dinitrobenzene	mg/kg	0.71	--	--	--	--	--	0.71	1/10th ADEC - Direct Contact
EXPLOSIVE	118-96-7	2,4,6-Trinitrotoluene	mg/kg	4.4	--	--	--	--	--	4.4	1/10th ADEC - Direct Contact
EXPLOSIVE	121-14-2	2,4-Dinitrotoluene	mg/kg	0.88	--	--	--	--	--	0.88	1/10th ADEC - Direct Contact
EXPLOSIVE	606-20-2	2,6-Dinitrotoluene	mg/kg	0.89	--	--	--	--	--	0.89	1/10th ADEC - Direct Contact
EXPLOSIVE	35572-78-2	2-Amino-4,6-dinitrotoluene	mg/kg	2	--	--	--	--	--	2	1/10th ADEC - Direct Contact
EXPLOSIVE	88-72-2	2-Nitrotoluene	mg/kg	2.6	--	--	--	--	--	2.6	1/10th ADEC - Direct Contact
EXPLOSIVE	99-08-1	3-Nitrotoluene	mg/kg	150	--	--	--	--	--	150	1/10th ADEC - Direct Contact
EXPLOSIVE	19406-51-0	4-Amino-2,6-dinitrotoluene	mg/kg	1.9	--	--	--	--	--	1.9	1/10th ADEC - Direct Contact
EXPLOSIVE	99-99-0	4-Nitrotoluene	mg/kg	35	--	--	--	--	--	35	1/10th ADEC - Direct Contact
EXPLOSIVE	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	mg/kg	7.2	--	--	--	--	--	7.2	1/10th ADEC - Direct Contact
EXPLOSIVE	479-45-8	Methyl-2,4,6-trinitrophenylnitramine	mg/kg	40	--	--	--	--	--	40	1/10th ADEC - Direct Contact
EXPLOSIVE	98-95-3	Nitrobenzene	mg/kg	5.1	12	--	--	--	--	5.1	1/10th ADEC - Direct Contact
EXPLOSIVE	55-63-0	Nitroglycerin	mg/kg	30	--	--	--	--	--	30	1/10th ADEC - Direct Contact
EXPLOSIVE	2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-	mg/kg	460	--	--	--	--	--	460	1/10th ADEC - Direct Contact

The ADEC Method 2 cleanup levels are based on an excess lifetime cancer risk (ELCR) of 1 x 10^{-5} and a hazard index (HI) of 1, consequently the ADEC values for direct contact and outdoor inhalation listed in Tables B1/B2 were divided by 10 prior to selection of the lowest applicable value.

The residential RSLs for noncarcinogenic chemicals are based on a HI of 1. Therefore, to account for possible cumulative risk associated with multiple chemical exposures, the listed RSLs for noncarcinogens were divided by 10.

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

mg/kg = milligrams per kilogram
RSL = Regional Screening Level (EPA, December 2009)
ADEC CUL = Alaska Department of Environmental Conservation Method 2 Soil Cleanup Levels (18 AAC 75)
Ft WW = Fort Wainwright

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
VOC	1,1,1,2-Tetrachloroethane	630-20-6	µg/L	--	0.52	--	0.52	RSL
VOC	1,1,1-Trichloroethane	71-55-6	µg/L	20	--	--	20	1/10th ADEC CUL
VOC	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.43	--	--	0.43	1/10th ADEC CUL
VOC	1,1,2-Trichloroethane	79-00-5	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	1,1-Dichloroethane	75-34-3	µg/L	730	--	--	730	1/10th ADEC CUL
VOC	1,1-Dichloroethene	75-35-4	µg/L	0.7	--	--	0.7	1/10th ADEC CUL
VOC	1,2,3-Trichlorobenzene	87-61-6	µg/L	--	2.9	--	2.9	1/10th RSL
VOC	1,2,3-Trichloropropane	96-18-4	µg/L	0.012	--	--	0.012	1/10th ADEC CUL
VOC	1,2,4-Trichlorobenzene	120-82-1	µg/L	7	--	--	7	1/10th ADEC CUL
VOC	1,2,4-Trimethylbenzene	95-63-6	µg/L	180	--	--	180	1/10th ADEC CUL
VOC	1,2-Dibromo-3-chloropropane	96-12-8	µg/L	--	0.00032	--	0.00032	RSL
VOC	1,2-Dibromoethane	106-93-4	µg/L	0.005	--	--	0.005	1/10th ADEC CUL
VOC	1,2-Dichlorobenzene	95-50-1	µg/L	60	--	--	60	1/10th ADEC CUL
VOC	1,2-Dichloroethane	107-06-2	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	1,2-Dichloropropane	78-87-5	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	1,3,5-Trimethylbenzene	108-67-8	µg/L	180	--	--	180	1/10th ADEC CUL
VOC	1,3-Dichlorobenzene	541-73-1	µg/L	330	--	--	330	1/10th ADEC CUL
VOC	1,3-Dichloropropane	142-28-9	µg/L	--	73	--	73	1/10th RSL
VOC	1,4-Dichlorobenzene	106-46-7	µg/L	7.5	--	--	7.5	1/10th ADEC CUL
VOC	2-Butanone	78-93-3	µg/L	2200	--	--	2200	1/10th ADEC CUL
VOC	2-Chlorotoluene	95-49-8	µg/L	--	73	--	73	1/10th RSL
VOC	2-Hexanone	591-78-6	µg/L	--	4.7	--	4.7	1/10th RSL
VOC	4-Chlorotoluene	106-43-4	µg/L	--	260	--	260	1/10th RSL
VOC	4-Methyl-2-pentanone	108-10-1	µg/L	290	--	--	290	1/10th ADEC CUL
VOC	Acetone	67-64-1	µg/L	3300	--	--	3300	1/10th ADEC CUL
VOC	Benzene	71-43-2	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	Bromobenzene	108-86-1	µg/L	--	8.8	--	8.8	1/10th RSL
VOC	Bromodichloromethane	75-27-4	µg/L	1.4	--	--	1.4	1/10th ADEC CUL
VOC	Bromoform	75-25-2	µg/L	11	--	--	11	1/10th ADEC CUL
VOC	Bromomethane	74-83-9	µg/L	5.1	--	--	5.1	1/10th ADEC CUL
VOC	Carbon Disulfide	75-15-0	µg/L	370	--	--	370	1/10th ADEC CUL
VOC	Carbon tetrachloride	56-23-5	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	Chlorobenzene	108-90-7	µg/L	10	--	--	10	1/10th ADEC CUL
VOC	Chloroethane	75-00-3	µg/L	29	--	--	29	1/10th ADEC CUL
VOC	Chloroform	67-66-3	µg/L	14	--	--	14	1/10th ADEC CUL

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
VOC	Chloromethane	74-87-3	µg/L	6.6	--	--	6.6	1/10th ADEC CUL
VOC	cis-1,2-Dichloroethene	156-59-2	µg/L	7	--	--	7	1/10th ADEC CUL
VOC	Dibromochloromethane	124-48-1	µg/L	1	--	--	1	1/10th ADEC CUL
VOC	Dibromomethane	74-95-3	µg/L	37	--	--	37	1/10th ADEC CUL
VOC	Dichlorodifluoromethane	75-71-8	µg/L	730	--	--	730	1/10th ADEC CUL
VOC	Ethylbenzene	100-41-4	µg/L	70	--	--	70	1/10th ADEC CUL
VOC	Hexachlorobutadiene	87-68-3	µg/L	0.72	--	--	0.72	1/10th ADEC CUL
VOC	Isopropylbenzene	98-82-8	µg/L	370	--	--	370	1/10th ADEC CUL
VOC	m,p-Xylene	108-38-3/1	µg/L				120	1/10th RSL
VOC	Methylene chloride	75-09-2	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	Methyl-tert-butyl ether (MTBE)	1634-04-4	µg/L	47	--	--	47	1/10th ADEC CUL
VOC	n-Butylbenzene	104-51-8	µg/L	37	--	--	37	1/10th ADEC CUL
VOC	n-Propylbenzene	103-65-1	µg/L	37	--	--	37	1/10th ADEC CUL
VOC	sec-Butylbenzene	135-98-8	µg/L	37	--	--	37	1/10th ADEC CUL
VOC	Styrene	100-42-5	µg/L	10	--	--	10	1/10th ADEC CUL
VOC	tert-Butylbenzene	98-06-6	µg/L	37	--	--	37	1/10th ADEC CUL
VOC	Tetrachloroethene (PCE)	127-18-4	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	Toluene	108-88-3	µg/L	100	--	--	100	1/10th ADEC CUL
VOC	trans-1,2-Dichloroethene	156-60-5	µg/L	10	--	--	10	1/10th ADEC CUL
VOC	Trichloroethene (TCE)	79-01-6	µg/L	0.5	--	--	0.5	1/10th ADEC CUL
VOC	Trichlorofluoromethane	75-69-4	µg/L	1100	--	--	1100	1/10th ADEC CUL
VOC	Vinyl chloride	75-01-4	µg/L	0.2	--	--	0.2	1/10th ADEC CUL
VOC	Xylenes, Total	1330-20-7	µg/L	1000	--	--	1000	1/10th ADEC CUL
TPH	DRO	PHCD	µg/L	150		--	150	1/10th ADEC CUL
TPH	GRO	PHCG	µg/L	220		--	220	1/10th ADEC CUL
TPH	RRO	TPH-Oil	µg/L	110	--	--	110	1/10th ADEC CUL
SVOC	2,4,5-Trichlorophenol	95-95-4	µg/L	370	--	--	370	1/10th ADEC CUL
SVOC	2,4,6-Trichlorophenol	88-06-2	µg/L	7.7	--	--	7.7	1/10th ADEC CUL
SVOC	2,4-Dichlorophenol	120-83-2	µg/L	11	--	--	11	1/10th ADEC CUL
SVOC	2,4-Dimethylphenol	105-67-9	µg/L	73	--	--	73	1/10th ADEC CUL
SVOC	2,4-Dinitrophenol	51-28-5	µg/L	7.3	--	--	7.3	1/10th ADEC CUL
SVOC	2-Chloronaphthalene	91-58-7	µg/L	290	--	--	290	1/10th ADEC CUL
SVOC	2-Chlorophenol	95-57-8	µg/L	18	--	--	18	1/10th ADEC CUL
SVOC	2-Methyl-4,6-dinitrophenol	534-52-1	µg/L	--	0.37	--	0.37	1/10th RSL
SVOC	2-Methylphenol (o-Cresol)	95-48-7	µg/L	180	--	--	180	1/10th ADEC CUL

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
SVOC	2-Nitroaniline	88-74-4	µg/L	--	37	--	37	1/10th RSL
SVOC	3,3'-Dichlorobenzidine	91-94-1	µg/L	0.19	--	--	0.19	1/10th ADEC CUL
SVOC	3&4-Methylphenol	108-39-4/106	µg/L	--	18	--	18	1/10th ADEC CUL for p-cresol
SVOC	4-Chloro-3-methylphenol	59-50-7	µg/L	--	370	--	370	1/10th RSL
SVOC	4-Chloroaniline	106-47-8	µg/L	1.6	--	--	1.6	1/10th ADEC CUL
SVOC	Azobenzene	103-33-3	µg/L	--	0.12	--	0.12	RSL
SVOC	Benzoic acid	65-85-0	µg/L	15000	--	--	15000	1/10th ADEC CUL
SVOC	Benzyl alcohol	100-51-6	µg/L	--	370	--	370	1/10th RSL
SVOC	Benzyl butyl phthalate	85-68-7	µg/L	730	--	--	730	1/10th ADEC CUL
SVOC	bis-(2-Chloroethoxy)methane	111-91-1	µg/L	--	11	--	11	1/10th RSL
SVOC	bis-(2-Chloroethyl)ether	111-44-4	µg/L	0.077	--	--	0.077	1/10th ADEC CUL
SVOC	bis(2-Chloroisopropyl)ether	108-60-1	µg/L	--	0.32	--	0.32	RSL
SVOC	bis-(2-Ethylhexyl)phthalate	117-81-7	µg/L	0.6	--	--	0.6	1/10th ADEC CUL
SVOC	Carbazole	86-74-8	µg/L	4.3	--	--	4.3	1/10th ADEC CUL
SVOC	Dibenzofuran	132-64-9	µg/L	7.3	--	--	7.3	1/10th ADEC CUL
SVOC	Diethyl phthalate	84-66-2	µg/L	2900	--	--	2900	1/10th ADEC CUL
SVOC	Dimethyl phthalate	131-11-3	µg/L	37000	--	--	37000	1/10th ADEC CUL
SVOC	Di-n-butyl phthalate	84-74-2	µg/L	370	--	--	370	1/10th ADEC CUL
SVOC	Di-n-octyl phthalate	117-84-0	µg/L	150	--	--	150	1/10th ADEC CUL
SVOC	Hexachlorobenzene	118-74-1	µg/L	0.1	--	--	0.1	1/10th ADEC CUL
SVOC	Hexachloroethane	67-72-1	µg/L	4	--	--	4	1/10th ADEC CUL
SVOC	Isophorone	78-59-1	µg/L	90	--	--	90	1/10th ADEC CUL
SVOC	n-Nitrosodimethylamine	62-75-9	µg/L	0.0017	--	--	0.0017	1/10th ADEC CUL
SVOC	n-Nitrosodi-n-propylamine	621-64-7	µg/L	0.012	--	--	0.012	1/10th ADEC CUL
SVOC	n-Nitrosodiphenylamine	86-30-6	µg/L	17	--	--	17	1/10th ADEC CUL
SVOC	Pentachlorophenol	87-86-5	µg/L	0.1	--	--	0.1	1/10th ADEC CUL
SVOC	Phenol	108-95-2	µg/L	1100	--	--	1100	1/10th ADEC CUL
PESTICIDES	4,4'-DDD	72-54-8	µg/L	0.35	--	--	0.35	1/10th ADEC CUL
PESTICIDES	4,4'-DDE	72-55-9	µg/L	0.25	--	--	0.25	1/10th ADEC CUL
PESTICIDES	4,4'-DDT	50-29-3	µg/L	0.25	--	--	0.25	1/10th ADEC CUL
PESTICIDES	Aldrin	309-00-2	µg/L	0.005	--	--	0.005	1/10th ADEC CUL
PESTICIDES	alpha-BHC	319-84-6	µg/L	0.014	--	--	0.014	1/10th ADEC CUL
PESTICIDES	beta-BHC	319-85-7	µg/L	0.047	--	--	0.047	1/10th ADEC CUL
PESTICIDES	Dieldrin	60-57-1	µg/L	0.0053	--	--	0.0053	1/10th ADEC CUL
PESTICIDES	Endrin	72-20-8	µg/L	0.2	--	--	0.2	1/10th ADEC CUL

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
PESTICIDES	gamma-BHC (Lindane)	58-89-9	µg/L	0.02	--	--	0.02	1/10th ADEC CUL
PESTICIDES	gamma-Chlordane	12789-03-6	µg/L	--	0.19	--	0.19	RSL
PESTICIDES	Heptachlor	76-44-8	µg/L	0.04	--	--	0.04	1/10th ADEC CUL
PESTICIDES	Heptachlor epoxide	1024-57-3	µg/L	0.02	--	--	0.02	1/10th ADEC CUL
PESTICIDES	Methoxychlor	72-43-5	µg/L	4	--	--	4	1/10th ADEC CUL
PESTICIDES	Toxaphene	8001-35-2	µg/L	0.3	--	--	0.3	1/10th ADEC CUL
PCBs	PCB-1016 (Aroclor 1016)	12674-11-2	µg/L	--	0.96	--	0.96	RSL
PCBs	PCB-1221 (Aroclor 1221)	11104-28-2	µg/L	--	0.0068	--	0.0068	RSL
PCBs	PCB-1232 (Aroclor 1232)	11141-16-5	µg/L	--	0.0068	--	0.0068	RSL
PCBs	PCB-1242 (Aroclor 1242)	53469-21-9	µg/L	--	0.034	--	0.034	RSL
PCBs	PCB-1248 (Aroclor 1248)	12672-29-6	µg/L	--	0.034	--	0.034	RSL
PCBs	PCB-1254 (Aroclor 1254)	11097-69-1	µg/L	--	0.034	--	0.034	RSL
PCBs	PCB-1260 (Aroclor 1260)	11096-82-5	µg/L	--	0.034	--	0.034	RSL
PAH	2-Methylnaphthalene	91-57-6	µg/L	15	--	--	15	1/10th ADEC CUL
PAH	Acenaphthene	83-32-9	µg/L	220	--	--	220	1/10th ADEC CUL
PAH	Acenaphthylene	208-96-8	µg/L	220	--	--	220	1/10th ADEC CUL
PAH	Anthracene	120-12-7	µg/L	1100	--	--	1100	1/10th ADEC CUL
PAH	Benzo(a)anthracene	56-55-3	µg/L	0.12	--	--	0.12	1/10th ADEC CUL
PAH	Benzo(a)pyrene	50-32-8	µg/L	0.02	--	--	0.02	1/10th ADEC CUL
PAH	Benzo(b)fluoranthene	205-99-2	µg/L	0.12	--	--	0.12	1/10th ADEC CUL
PAH	Benzo(g,h,i)perylene	191-24-2	µg/L	110	--	--	110	1/10th ADEC CUL
PAH	Benzo(k)fluoranthene	207-08-9	µg/L	1.2	--	--	1.2	1/10th ADEC CUL
PAH	Chrysene	218-01-9	µg/L	12	--	--	12	1/10th ADEC CUL
PAH	Dibenzo(a,h)anthracene	53-70-3	µg/L	0.012	--	--	0.012	1/10th ADEC CUL
PAH	Fluoranthene	206-44-0	µg/L	150	--	--	150	1/10th ADEC CUL
PAH	Fluorene	86-73-7	µg/L	150	--	--	150	1/10th ADEC CUL
PAH	Indeno(1,2,3-cd)pyrene	193-39-5	µg/L	0.12	--	--	0.12	1/10th ADEC CUL
PAH	Naphthalene	91-20-3	µg/L	73	--	--	73	1/10th ADEC CUL
PAH	Phenanthrene	85-01-8	µg/L	1100	--	--	1100	1/10th ADEC CUL
PAH	Pyrene	129-00-0	µg/L	110	--	--	110	1/10th ADEC CUL
OTHER	1-chloro-1,1-difluoroethane	75-68-3	µg/L	--	10000	--	10000	1/10th RSL
METALS	Aluminum	7429-90-5	µg/L	--	--	7538	7538	EAFB background (total)
METALS	Antimony	7440-36-0	µg/L	0.6	--	--	0.6	1/10th ADEC CUL
METALS	Arsenic	7440-38-2	µg/L	1	--	36.24	36.24	Ft WW background (total)
METALS	Barium	7440-39-3	µg/L	200	--	551.22	551.22	Ft WW background (total)

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
METALS	Beryllium	7440-41-7	µg/L	0.4	--	--	0.4	1/10th ADEC CUL
METALS	Boron	7440-42-8	µg/L	--	730	--	730	1/10th RSL
METALS	Cadmium	7440-43-9	µg/L	0.5	--	5.38	5.38	Ft WW background (total)
METALS	Chromium	7440-47-3	µg/L	10	--	53.01	53.01	Ft WW background (total)
METALS	Cobalt	7440-48-4	µg/L	--	1.1	32*	1.1	1/10th RSL
METALS	Copper	7440-50-8	µg/L	100	--	75	100	1/10th ADEC CUL
METALS	Iron	7439-89-6	µg/L	--	--	16938	16938	EAFB background (total)
METALS	Lead	7439-92-1	µg/L	1.5	--	34.07	34.07	Ft WW background (total)
METALS	Manganese	7439-96-5	µg/L	--	--	3875	3875	EAFB background (total)
METALS	Mercury	7439-97-6	µg/L	0.2	--	--	0.2	1/10th ADEC CUL
METALS	Nickel	7440-02-0	µg/L	10	--	31	10	1/10th ADEC CUL
METALS	Selenium	7782-49-2	µg/L	5	--	--	5	1/10th ADEC CUL
METALS	Silver	7440-22-4	µg/L	10	--	--	10	1/10th ADEC CUL
METALS	Thallium	7440-28-0	µg/L	0.2	--	--	0.2	1/10th ADEC CUL
METALS	Vanadium	7440-62-2	µg/L	26	--	24	26	1/10th ADEC CUL
METALS	Zinc	7440-66-6	µg/L	500	--	63	500	1/10th ADEC CUL
HERBICIDES	2,4,5-T	93-76-5	µg/L	--	37	--	37	1/10th RSL
HERBICIDES	2,4,5-TP (Silvex)	93-72-1	µg/L	5	--	--	5	1/10th ADEC CUL
HERBICIDES	2,4-D	94-75-7	µg/L	7	--	--	7	1/10th ADEC CUL
HERBICIDES	2,4-DB	94-82-6	µg/L	--	29	--	29	1/10th RSL

TABLE 3-2
Project Screening Levels for Groundwater
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	CAS Number	Units	1/10th 2009 ADEC Table C Groundwater Cleanup Levels	2010 EPA RSL (Adjusted for Noncarcinogens)	Background	2010 Groundwater PSL	Source
HERBICIDES	Dalapon	75-99-0	µg/L	--	110	--	110	1/10th RSL
HERBICIDES	Dicamba	1918-00-9	µg/L	--	110	--	110	1/10th RSL
HERBICIDES	Dinoseb	88-85-7	µg/L	--	3.7	--	3.7	1/10th RSL
HERBICIDES	MCPP (2-(2-methyl-4-	93-65-2	µg/L	--	3.7	--	3.7	1/10th RSL
EXPLOSIVES	1,3,5-Trinitrobenzene	99-35-4	µg/L	110	--	--	110	1/10th ADEC CUL
EXPLOSIVES	1,3-Dinitrobenzene	99-65-0	µg/L	0.37	--	--	0.37	1/10th ADEC CUL
EXPLOSIVES	2,4,6-Trinitrotoluene	118-96-7	µg/L	1.8	--	--	1.8	1/10th ADEC CUL
EXPLOSIVES	2,4-Dinitrotoluene	121-14-2	µg/L	0.13	--	--	0.13	1/10th ADEC CUL
EXPLOSIVES	2,6-Dinitrotoluene	606-20-2	µg/L	0.13	--	--	0.13	1/10th ADEC CUL
EXPLOSIVES	2-Amino-4,6-dinitrotoluene	35572-78-2	µg/L	0.73		--	0.73	1/10th ADEC CUL
EXPLOSIVES	2-Nitrotoluene	88-72-2	µg/L	0.37	--	--	0.37	1/10th ADEC CUL
EXPLOSIVES	3-Nitrotoluene	99-08-1	µg/L	73	--	--	73	1/10th ADEC CUL
EXPLOSIVES	4-Amino-2,6-dinitrotoluene	19406-51-0	µg/L	0.73		--	0.73	1/10th ADEC CUL
EXPLOSIVES	4-Nitrotoluene	99-99-0	µg/L	5	--	--	5	1/10th ADEC CUL
EXPLOSIVES	Hexahydro-1,3,5-trinitro-1,3,5-	121-82-4	µg/L	0.77	--	--	0.77	1/10th ADEC CUL
EXPLOSIVES	Methyl-2,4,6-	479-45-8	µg/L	15	--	--	15	1/10th ADEC CUL
EXPLOSIVES	Nitrobenzene	98-95-3	µg/L	1.8	--	--	1.8	1/10th ADEC CUL
EXPLOSIVES	Octahydro-1,3,5,7-tetranitro-	2691-41-0	µg/L	180	--	--	180	1/10th ADEC CUL

The ADEC Method 2 cleanup levels are based on an excess lifetime cancer risk (ELCR) of 1 x 10^{-5} and a hazard index (HI) of 1, consequently the ADEC values listed in Table C were divided by 10 prior to selection of the lowest applicable value.

The drinking water RSLs for noncarcinogenic chemicals are based on a HI of 1. Therefore, to account for possible cumulative risk associated with multiple chemical exposures, the listed RSLs for non-carcinogens were divided by 10.
µg/L = micrograms per liter
VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry
RSL = Regional Screening Level (EPA, December 2009)
ADEC CUL = Alaska Department of Environmental Conservation Method 2 Groundwater Cleanup Levels (18 AAC 75)
FTWW = Fort Wainwright
EAFB = Eielson Air Force Base

TABLE 3-3
Project Screening Levels for Soil Gas
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	2010 Soil Gas PSL	Source
VOC	71-55-6	1,1,1-Trichloroethane	ug/m3	2,290	1/10th ADEC Res Shallow SG Target Value
VOC	79-34-5	1,1,2,2-Tetrachloroethane	ug/m3	0.42	1/10th ADEC Res Shallow SG Target Value
VOC	79-00-5	1,1,2-Trichloroethane	ug/m3	1.5	1/10th ADEC Res Shallow SG Target Value
VOC	75-34-3	1,1-Dichloroethane	ug/m3	520	1/10th ADEC Res Shallow SG Target Value
VOC	75-35-4	1,1-Dichloroethene	ug/m3	0.49	1/10th ADEC Res Shallow SG Target Value
VOC	96-18-4	1,2,3-Trichloropropane	ug/m3	0.012	1/10th ADEC Res Shallow SG Target Value
VOC	120-82-1	1,2,4-Trichlorobenzene	ug/m3	4.2	1/10th ADEC Res Shallow SG Target Value
VOC	95-63-6	1,2,4-Trimethylbenzene	ug/m3	7.3	1/10th ADEC Res Shallow SG Target Value
VOC	106-93-4	1,2-Dibromoethane	ug/m3	0.041	1/10th ADEC Res Shallow SG Target Value
VOC	95-50-1	1,2-Dichlorobenzene	ug/m3	210	1/10th ADEC Res Shallow SG Target Value
VOC	107-06-2	1,2-Dichloroethane	ug/m3	0.94	1/10th ADEC Res Shallow SG Target Value
VOC	78-87-5	1,2-Dichloropropane	ug/m3	1.3	1/10th ADEC Res Shallow SG Target Value
VOC	108-67-8	1,3,5-Trimethylbenzene	ug/m3	7.3	1/10th ADEC Res Shallow SG Target Value
VOC	541-73-1	1,3-Dichlorobenzene	ug/m3	210	1/10th ADEC Res Shallow SG Target Value
VOC	106-46-7	1,4-Dichlorobenzene	ug/m3	3.5	1/10th ADEC Res Shallow SG Target Value
VOC	78-93-3	2-Butanone	ug/m3	5,210	1/10th ADEC Res Shallow SG Target Value
VOC	108-10-1	4-Methyl-2-pentanone	ug/m3	3,130	1/10th ADEC Res Shallow SG Target Value
VOC	67-64-1	Acetone	ug/m3	3,290	1/10th ADEC Res Shallow SG Target Value
VOC	71-43-2	Benzene	ug/m3	3.1	1/10th ADEC Res Shallow SG Target Value
VOC	75-27-4	Bromodichloromethane	ug/m3	1.4	1/10th ADEC Res Shallow SG Target Value
VOC	75-25-2	Bromoform	ug/m3	22	1/10th ADEC Res Shallow SG Target Value
VOC	74-83-9	Bromomethane	ug/m3	5.2	1/10th ADEC Res Shallow SG Target Value
VOC	75-15-0	Carbon Disulfide	ug/m3	730	1/10th ADEC Res Shallow SG Target Value
VOC	56-23-5	Carbon tetrachloride	ug/m3	1.6	1/10th ADEC Res Shallow SG Target Value
VOC	108-90-7	Chlorobenzene	ug/m3	52	1/10th ADEC Res Shallow SG Target Value
VOC	75-00-3	Chloroethane	ug/m3	29	1/10th ADEC Res Shallow SG Target Value
VOC	67-66-3	Chloroform	ug/m3	1.1	1/10th ADEC Res Shallow SG Target Value
VOC	74-87-3	Chloromethane	ug/m3	14	1/10th ADEC Res Shallow SG Target Value
VOC	156-59-2	cis-1,2-Dichloroethene	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	124-48-1	Dibromochloromethane	ug/m3	1	1/10th ADEC Res Shallow SG Target Value
VOC	74-95-3	Dibromomethane	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	75-71-8	Dichlorodifluoromethane	ug/m3	210	1/10th ADEC Res Shallow SG Target Value

TABLE 3-3

Project Screening Levels for Soil Gas

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	2010 Soil Gas PSL	Source
VOC	100-41-4	Ethylbenzene	ug/m3	22	1/10th ADEC Res Shallow SG Target Value
VOC	87-68-3	Hexachlorobutadiene	ug/m3	1.11	1/10th ADEC Res Shallow SG Target Value
VOC	98-82-8	Isopropylbenzene	ug/m3	420	1/10th ADEC Res Shallow SG Target Value
VOC	75-09-2	Methylene chloride	ug/m3	52	1/10th ADEC Res Shallow SG Target Value
VOC	1634-04-4	Methyl-tert-butyl ether (MTBE)	ug/m3	47	1/10th ADEC Res Shallow SG Target Value
VOC	104-51-8	n-Butylbenzene	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	103-65-1	n-Propylbenzene	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	135-98-8	sec-Butylbenzene	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	100-42-5	Styrene	ug/m3	1,040	1/10th ADEC Res Shallow SG Target Value
VOC	98-06-6	tert-Butylbenzene	ug/m3	37	1/10th ADEC Res Shallow SG Target Value
VOC	127-18-4	Tetrachloroethene (PCE)	ug/m3	4.1	1/10th ADEC Res Shallow SG Target Value
VOC	108-88-3	Toluene	ug/m3	5,210	1/10th ADEC Res Shallow SG Target Value
VOC	156-60-5	trans-1,2-Dichloroethene	ug/m3	63	1/10th ADEC Res Shallow SG Target Value
VOC	79-01-6	Trichloroethene (TCE)	ug/m3	0.22	1/10th ADEC Res Shallow SG Target Value
VOC	75-69-4	Trichlorofluoromethane	ug/m3	730	1/10th ADEC Res Shallow SG Target Value
VOC	75-01-4	Vinyl chloride	ug/m3	0.81	1/10th ADEC Res Shallow SG Target Value
VOC	1330-20-7	Xylenes, Total	ug/m3	100	1/10th ADEC Res Shallow SG Target Value
PAH	91-20-3	Naphthalene	ug/m3	0.72	1/10th ADEC Res Shallow SG Target Value

Notes:

ug/m3 = micrograms per cubic meter of air

VOC = volatile organic compounds

PAH = polynuclear aromatic hydrocarbons

ADEC = Alaska Department of Environmental Conservation - Draft Vapor Intrusion Guidance for Contaminated Sites - Appendix E (July 2009)

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
VOC	630-20-6	1,1,1,2-Tetrachloroethane	mg/kg	0.0002	RSL Groundwater Protection Value
VOC	71-55-6	1,1,1-Trichloroethane	mg/kg	0.82	ADEC Table B1/B2 Migration to Groundwater Value
VOC	79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	0.017	ADEC Table B1/B2 Migration to Groundwater Value
VOC	79-00-5	1,1,2-Trichloroethane	mg/kg	0.018	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-34-3	1,1-Dichloroethane	mg/kg	25	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-35-4	1,1-Dichloroethene	mg/kg	0.03	ADEC Table B1/B2 Migration to Groundwater Value
VOC	87-61-6	1,2,3-Trichlorobenzene	mg/kg	0.087	RSL Groundwater Protection Value
VOC	96-18-4	1,2,3-Trichloropropane	mg/kg	0.00053	ADEC Table B1/B2 Migration to Groundwater Value
VOC	120-82-1	1,2,4-Trichlorobenzene	mg/kg	0.85	ADEC Table B1/B2 Migration to Groundwater Value
VOC	95-63-6	1,2,4-Trimethylbenzene	mg/kg	23	ADEC Table B1/B2 Migration to Groundwater Value
VOC	96-12-8	1,2-Dibromo-3-chloropropane	mg/kg	0.00000014	RSL Groundwater Protection Value
VOC	106-93-4	1,2-Dibromoethane	mg/kg	0.00016	ADEC Table B1/B2 Migration to Groundwater Value
VOC	95-50-1	1,2-Dichlorobenzene	mg/kg	5.1	ADEC Table B1/B2 Migration to Groundwater Value
VOC	107-06-2	1,2-Dichloroethane	mg/kg	0.016	ADEC Table B1/B2 Migration to Groundwater Value
VOC	78-87-5	1,2-Dichloropropane	mg/kg	0.018	ADEC Table B1/B2 Migration to Groundwater Value
VOC	108-67-8	1,3,5-Trimethylbenzene	mg/kg	23	ADEC Table B1/B2 Migration to Groundwater Value
VOC	541-73-1	1,3-Dichlorobenzene	mg/kg	28	ADEC Table B1/B2 Migration to Groundwater Value
VOC	142-28-9	1,3-Dichloropropane	mg/kg	0.25	RSL Groundwater Protection Value
VOC	106-46-7	1,4-Dichlorobenzene	mg/kg	0.64	ADEC Table B1/B2 Migration to Groundwater Value
VOC	78-93-3	2-Butanone	mg/kg	59	ADEC Table B1/B2 Migration to Groundwater Value
VOC	95-49-8	2-Chlorotoluene	mg/kg	0.71	RSL Groundwater Protection Value
VOC	591-78-6	2-Hexanone	mg/kg	0.011	RSL Groundwater Protection Value
VOC	78-83-1	2-Methyl-1-propanol	mg/kg	2.3	RSL Groundwater Protection Value
VOC	106-43-4	4-Chlorotoluene	mg/kg	2.5	RSL Groundwater Protection Value
VOC	108-10-1	4-Methyl-2-pentanone	mg/kg	8.1	ADEC Table B1/B2 Migration to Groundwater Value
VOC	67-64-1	Acetone	mg/kg	88	ADEC Table B1/B2 Migration to Groundwater Value
VOC	71-43-2	Benzene	mg/kg	0.025	ADEC Table B1/B2 Migration to Groundwater Value
VOC	108-86-1	Bromobenzene	mg/kg	0.059	RSL Groundwater Protection Value
VOC	75-27-4	Bromodichloromethane	mg/kg	0.044	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-25-2	Bromoform	mg/kg	0.34	ADEC Table B1/B2 Migration to Groundwater Value
VOC	74-83-9	Bromomethane	mg/kg	0.16	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-15-0	Carbon Disulfide	mg/kg	12	ADEC Table B1/B2 Migration to Groundwater Value
VOC	56-23-5	Carbon tetrachloride	mg/kg	0.023	ADEC Table B1/B2 Migration to Groundwater Value
VOC	108-90-7	Chlorobenzene	mg/kg	0.63	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-00-3	Chloroethane	mg/kg	580	ADEC Table B1/B2 Migration to Groundwater Value
VOC	67-66-3	Chloroform	mg/kg	0.46	ADEC Table B1/B2 Migration to Groundwater Value
VOC	74-87-3	Chloromethane	mg/kg	0.21	ADEC Table B1/B2 Migration to Groundwater Value
VOC	156-59-2	cis-1,2-Dichloroethene	mg/kg	0.24	ADEC Table B1/B2 Migration to Groundwater Value
VOC	124-48-1	Dibromochloromethane	mg/kg	0.032	ADEC Table B1/B2 Migration to Groundwater Value

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
VOC	74-95-3	Dibromomethane	mg/kg	1.1	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-71-8	Dichlorodifluoromethane	mg/kg	140	ADEC Table B1/B2 Migration to Groundwater Value
VOC	100-41-4	Ethylbenzene	mg/kg	6.9	ADEC Table B1/B2 Migration to Groundwater Value
VOC	87-68-3	Hexachlorobutadiene	mg/kg	0.12	ADEC Table B1/B2 Migration to Groundwater Value
VOC	110-54-3	Hexane	mg/kg	6.2	RSL Groundwater Protection Value
VOC	98-82-8	Isopropylbenzene	mg/kg	51	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-09-2	Methylene chloride	mg/kg	0.016	ADEC Table B1/B2 Migration to Groundwater Value
VOC	1634-04-4	Methyl-tert-butyl ether (MTBE)	mg/kg	1.3	ADEC Table B1/B2 Migration to Groundwater Value
VOC	104-51-8	n-Butylbenzene	mg/kg	15	ADEC Table B1/B2 Migration to Groundwater Value
VOC	103-65-1	n-Propylbenzene	mg/kg	15	ADEC Table B1/B2 Migration to Groundwater Value
VOC	95-47-6	o-Xylene	mg/kg	1.2	RSL Groundwater Protection Value
VOC	135-98-8	sec-Butylbenzene	mg/kg	12	ADEC Table B1/B2 Migration to Groundwater Value
VOC	100-42-5	Styrene	mg/kg	0.96	ADEC Table B1/B2 Migration to Groundwater Value
VOC	98-06-6	tert-Butylbenzene	mg/kg	12	ADEC Table B1/B2 Migration to Groundwater Value
VOC	127-18-4	Tetrachloroethene (PCE)	mg/kg	0.024	ADEC Table B1/B2 Migration to Groundwater Value
VOC	108-88-3	Toluene	mg/kg	6.5	ADEC Table B1/B2 Migration to Groundwater Value
VOC	156-60-5	trans-1,2-Dichloroethene	mg/kg	0.37	ADEC Table B1/B2 Migration to Groundwater Value
VOC	79-01-6	Trichloroethene (TCE)	mg/kg	0.02	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-69-4	Trichlorofluoromethane	mg/kg	86	ADEC Table B1/B2 Migration to Groundwater Value
VOC	76-13-1	Trichlorotrifluoroethane (Freon 113)	mg/kg	750	ADEC Table B1/B2 Migration to Groundwater Value
VOC	108-05-4	Vinyl Acetate	mg/kg	100	ADEC Table B1/B2 Migration to Groundwater Value
VOC	75-01-4	Vinyl chloride	mg/kg	0.0085	ADEC Table B1/B2 Migration to Groundwater Value
VOC	1330-20-7	Xylenes, Total	mg/kg	63	ADEC Table B1/B2 Migration to Groundwater Value
TPH	TPH-Diesel	DRO	mg/kg	250	ADEC Table B1/B2 Migration to Groundwater Value
TPH	TPH-Gasoline	GRO		300	ADEC Table B1/B2 Migration to Groundwater Value
TPH	TPH-Oil	RRO	mg/kg	11000	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	122-66-7	1,2-Diphenylhydrazine	mg/kg	0.00027	RSL Groundwater Protection Value
SVOC	95-95-4	2,4,5-Trichlorophenol	mg/kg	67	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	88-06-2	2,4,6-Trichlorophenol	mg/kg	1.4	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	120-83-2	2,4-Dichlorophenol	mg/kg	1.3	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	105-67-9	2,4-Dimethylphenol	mg/kg	8.8	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	51-28-5	2,4-Dinitrophenol	mg/kg	0.54	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	91-58-7	2-Chloronaphthalene	mg/kg	120	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	95-57-8	2-Chlorophenol	mg/kg	1.5	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	534-52-1	2-Methyl-4,6-dinitrophenol	mg/kg	0.0062	RSL Groundwater Protection Value
SVOC	95-48-7	2-Methylphenol (o-Cresol)	mg/kg	15	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	88-74-4	2-Nitroaniline	mg/kg	0.15	RSL Groundwater Protection Value
SVOC	91-94-1	3,3'-Dichlorobenzidine	mg/kg	0.19	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	59-50-7	4-Chloro-3-methylphenol	mg/kg	4.3	RSL Groundwater Protection Value

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
SVOC	106-47-8	4-Chloroaniline	mg/kg	0.057	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	106-44-5	4-Methylphenol (p-Cresol)	mg/kg	1.5	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	100-01-6	4-Nitroaniline	mg/kg	0.0014	RSL Groundwater Protection Value
SVOC	62-53-3	Aniline	mg/kg	0.004	RSL Groundwater Protection Value
SVOC	103-33-3	Azobenzene	mg/kg	0.00096	RSL Groundwater Protection Value
SVOC	65-85-0	Benzoic acid	mg/kg	410	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	100-51-6	Benzyl alcohol	mg/kg	0.89	RSL Groundwater Protection Value
SVOC	85-68-7	Benzyl butyl phthalate	mg/kg	920	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	111-91-1	bis-(2-Chloroethoxy)methane	mg/kg	0.025	RSL Groundwater Protection Value
SVOC	111-44-4	bis-(2-Chloroethyl)ether	mg/kg	0.0022	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	108-60-1	bis(2-Chloroisopropyl)ether	mg/kg	0.00012	RSL Groundwater Protection Value
SVOC	117-81-7	bis-(2-Ethylhexyl)phthalate	mg/kg	13	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	86-74-8	Carbazole	mg/kg	6.5	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	132-64-9	Dibenzofuran	mg/kg	11	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	84-66-2	Diethyl phthalate	mg/kg	130	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	131-11-3	Dimethyl phthalate	mg/kg	1100	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	84-74-2	Di-n-butyl phthalate	mg/kg	80	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	117-84-0	Di-n-octyl phthalate	mg/kg	3800	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	118-74-1	Hexachlorobenzene	mg/kg	0.047	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	77-47-4	Hexachlorocyclopentadiene	mg/kg	1.3	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	67-72-1	Hexachloroethane	mg/kg	0.21	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	78-59-1	Isophorone	mg/kg	3.1	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	62-75-9	n-Nitrosodimethylamine	mg/kg	0.000053	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	621-64-7	n-Nitrosodi-n-propylamine	mg/kg	0.0011	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	86-30-6	n-Nitrosodiphenylamine	mg/kg	15	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	87-86-5	Pentachlorophenol	mg/kg	0.047	ADEC Table B1/B2 Migration to Groundwater Value
SVOC	108-95-2	Phenol	mg/kg	68	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	72-54-8	4,4'-DDD	mg/kg	7.2	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	72-55-9	4,4'-DDE	mg/kg	5.1	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	50-29-3	4,4'-DDT	mg/kg	7.3	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	309-00-2	Aldrin	mg/kg	0.07	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	319-84-6	alpha-BHC	mg/kg	0.0064	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	319-85-7	beta-BHC	mg/kg	0.022	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	57-74-9	Chlordane	mg/kg	2.3	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	60-57-1	Dieldrin	mg/kg	0.0076	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	72-20-8	Endrin	mg/kg	0.29	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	58-89-9	gamma-BHC (Lindane)	mg/kg	0.0095	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	12789-03-6	gamma-Chlordane	mg/kg	0.013	RSL Groundwater Protection Value
PESTICIDES	76-44-8	Heptachlor	mg/kg	0.28	ADEC Table B1/B2 Migration to Groundwater Value

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
PESTICIDES	1024-57-3	Heptachlor epoxide	mg/kg	0.014	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	72-43-5	Methoxychlor	mg/kg	23	ADEC Table B1/B2 Migration to Groundwater Value
PESTICIDES	8001-35-2	Toxaphene	mg/kg	3.9	ADEC Table B1/B2 Migration to Groundwater Value
PCBs	12674-11-2	PCB-1016 (Aroclor 1016)	mg/kg	0.092	RSL Groundwater Protection Value
PCBs	11104-28-2	PCB-1221 (Aroclor 1221)	mg/kg	0.00012	RSL Groundwater Protection Value
PCBs	11141-16-5	PCB-1232 (Aroclor 1232)	mg/kg	0.00012	RSL Groundwater Protection Value
PCBs	53469-21-9	PCB-1242 (Aroclor 1242)	mg/kg	0.0053	RSL Groundwater Protection Value
PCBs	12672-29-6	PCB-1248 (Aroclor 1248)	mg/kg	0.0052	RSL Groundwater Protection Value
PCBs	11097-69-1	PCB-1254 (Aroclor 1254)	mg/kg	0.0088	RSL Groundwater Protection Value
PCBs	11096-82-5	PCB-1260 (Aroclor 1260)	mg/kg	0.024	RSL Groundwater Protection Value
PAH	91-57-6	2-Methylnaphthalene	mg/kg	6.1	ADEC Table B1/B2 Migration to Groundwater Value
PAH	83-32-9	Acenaphthene	mg/kg	180	ADEC Table B1/B2 Migration to Groundwater Value
PAH	208-96-8	Acenaphthylene	mg/kg	180	ADEC Table B1/B2 Migration to Groundwater Value
PAH	120-12-7	Anthracene	mg/kg	3000	ADEC Table B1/B2 Migration to Groundwater Value
PAH	56-55-3	Benzo(a)anthracene	mg/kg	3.6	ADEC Table B1/B2 Migration to Groundwater Value
PAH	50-32-8	Benzo(a)pyrene	mg/kg	2.1	ADEC Table B1/B2 Migration to Groundwater Value
PAH	205-99-2	Benzo(b)fluoranthene	mg/kg	12	ADEC Table B1/B2 Migration to Groundwater Value
PAH	191-24-2	Benzo(g,h,i)perylene	mg/kg	38700	ADEC Table B1/B2 Migration to Groundwater Value
PAH	207-08-9	Benzo(k)fluoranthene	mg/kg	120	ADEC Table B1/B2 Migration to Groundwater Value
PAH	218-01-9	Chrysene	mg/kg	360	ADEC Table B1/B2 Migration to Groundwater Value
PAH	53-70-3	Dibenzo(a,h)anthracene	mg/kg	4	ADEC Table B1/B2 Migration to Groundwater Value
PAH	206-44-0	Fluoranthene	mg/kg	1400	ADEC Table B1/B2 Migration to Groundwater Value
PAH	86-73-7	Fluorene	mg/kg	220	ADEC Table B1/B2 Migration to Groundwater Value
PAH	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	41	ADEC Table B1/B2 Migration to Groundwater Value
PAH	91-20-3	Naphthalene	mg/kg	20	ADEC Table B1/B2 Migration to Groundwater Value
PAH	85-01-8	Phenanthrene	mg/kg	3000	ADEC Table B1/B2 Migration to Groundwater Value
PAH	129-00-0	Pyrene	mg/kg	1000	ADEC Table B1/B2 Migration to Groundwater Value
OTHER	75-68-3	1-chloro-1,1-difluoroethane	mg/kg	52	RSL Groundwater Protection Value
OTHER	75-37-6	Ethane, 1,1-difluoro-	mg/kg	28	RSL Groundwater Protection Value
OTHER	109-66-0	Pentane	mg/kg	10	RSL Groundwater Protection Value
METALS	7429-90-5	Aluminum	mg/kg	55000	RSL Groundwater Protection Value
METALS	7440-36-0	Antimony	mg/kg	3.6	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-38-2	Arsenic	mg/kg	8.46	FT WW Background
METALS	7440-39-3	Barium	mg/kg	1100	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-41-7	Beryllium	mg/kg	42	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-42-8	Boron	mg/kg	23	RSL Groundwater Protection Value
METALS	7440-43-9	Cadmium	mg/kg	5	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-43-9	Cadmium	mg/kg	5	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-43-9	Cadmium	mg/kg	5	ADEC Table B1/B2 Migration to Groundwater Value

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
METALS	7440-43-9	Cadmium	mg/kg	5	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-47-3	Chromium	mg/kg	25	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-48-4	Cobalt	mg/kg	0.49	RSL Groundwater Protection Value
METALS	7440-50-8	Copper	mg/kg	460	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7439-89-6	Iron	mg/kg	640	RSL Groundwater Protection Value
METALS	7439-96-5	Manganese	mg/kg	57	RSL Groundwater Protection Value
METALS	7439-96-5	Manganese	mg/kg	57	RSL Groundwater Protection Value
METALS	7439-97-6	Mercury	mg/kg	1.4	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7439-98-7	Molybdenum	mg/kg	3.7	RSL Groundwater Protection Value
METALS	7440-02-0	Nickel	mg/kg	86	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7782-49-2	Selenium	mg/kg	3.4	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-22-4	Silver	mg/kg	11.2	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-24-6	Strontium	mg/kg	770	RSL Groundwater Protection Value
METALS	7440-28-0	Thallium	mg/kg	1.9	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-62-2	Vanadium	mg/kg	3400	ADEC Table B1/B2 Migration to Groundwater Value
METALS	7440-66-6	Zinc	mg/kg	4100	ADEC Table B1/B2 Migration to Groundwater Value
HERBICIDES	93-76-5	2,4,5-T	mg/kg	0.15	RSL Groundwater Protection Value
HERBICIDES	93-72-1	2,4,5-TP (Silvex)	mg/kg	0.19	ADEC Table B1/B2 Migration to Groundwater Value
HERBICIDES	94-75-7	2,4-D	mg/kg	0.21	ADEC Table B1/B2 Migration to Groundwater Value
HERBICIDES	94-82-6	2,4-DB	mg/kg	0.12	RSL Groundwater Protection Value
HERBICIDES	75-99-0	Dalapon	mg/kg	0.23	RSL Groundwater Protection Value
HERBICIDES	1918-00-9	Dicamba	mg/kg	0.28	RSL Groundwater Protection Value
HERBICIDES	88-85-7	Dinoseb	mg/kg	0.32	RSL Groundwater Protection Value
HERBICIDES	94-74-6	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	0.0047	RSL Groundwater Protection Value
HERBICIDES	93-65-2	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	0.011	RSL Groundwater Protection Value
EXPLOSIVES	99-35-4	1,3,5-Trinitrobenzene	mg/kg	19	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	99-65-0	1,3-Dinitrobenzene	mg/kg	0.02	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	118-96-7	2,4,6-Trinitrotoluene	mg/kg	0.49	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	121-14-2	2,4-Dinitrotoluene	mg/kg	0.0093	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	606-20-2	2,6-Dinitrotoluene	mg/kg	0.0094	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	35572-78-2	2-Amino-4,6-dinitrotoluene	mg/kg	0.056	RSL Groundwater Protection Value
EXPLOSIVES	88-72-2	2-Nitrotoluene	mg/kg	0.025	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	99-08-1	3-Nitrotoluene	mg/kg	4.9	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	19406-51-0	4-Amino-2,6-dinitrotoluene	mg/kg	0.056	RSL Groundwater Protection Value
EXPLOSIVES	99-99-0	4-Nitrotoluene	mg/kg	0.34	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	0.04	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	479-45-8	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	4.5	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	98-95-3	Nitrobenzene	mg/kg	0.094	ADEC Table B1/B2 Migration to Groundwater Value
EXPLOSIVES	55-63-0	Nitroglycerin	mg/kg	0.22	ADEC Table B1/B2 Migration to Groundwater Value

TABLE 3-4
Migration to Groundwater Screening Levels for Soil
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	GWP PSL	Source
EXPLOSIVES	2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	49	ADEC Table B1/B2 Migration to Groundwater Value
DIOXIN/FURAN	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/g	0.000058	ADEC Table B1/B2 Migration to Groundwater Value

mg/kg = milligrams per kilogram
pg/g = picograms per gram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semivolatile organic compounds
PCB = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

FT WW = Fort Wainwright
RSL = Regional Screening Level (EPA, 2009)
ADEC CUL = Alaska Department of Environmental Conservation Method 2 Soil Cleanup Levels (18 AAC 75)

TABLE 3-5
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Soil Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL	Percent ND > PSL
2003 S&W														
VOC	1,2,3-Trichloropropane	mg/kg	--	5	0	0%	0.0182	0.026	--	--	0.017	--	5	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	5	0	0%	0.0729	0.104	--	--	0.0054	--	5	100%
2003/2004 COE														
VOC	1,2,3-Trichloropropane	mg/kg	--	24	0	0%	0.0391	0.1	--	--	0.017	--	24	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	24	0	0%	0.196	0.5	--	--	0.0054	--	24	100%
VOC	Trichloroethene (TCE)	mg/kg	--	24	0	0%	0.0391	0.1	--	--	0.057	--	9	38%
2005 Northwind														
VOC	1,2,3-Trichloropropane	mg/kg	--	64	0	0%	0.0236	83.4	--	--	0.017	--	64	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	64	0	0%	0.0472	1,670	--	--	0.0054	--	64	100%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	53	0	0%	1.97	20,300	--	--	0.61	--	53	100%
SVOC	Hexachlorobenzene	mg/kg	--	53	0	0%	0.246	2,540	--	--	0.15	--	53	100%
SVOC	Hexachlorocyclopentadiene	mg/kg	--	53	0	0%	0.985	10,200	--	--	0.2	--	53	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	53	0	0%	0.246	2,540	--	--	0.016	--	53	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	53	0	0%	0.246	2,540	--	--	0.052	--	53	100%
PAH	Benzo(a)pyrene	mg/kg	--	53	0	0%	0.246	2,540	--	--	0.049	--	53	100%
PAH	Dibenzo(a,h)anthracene	mg/kg	--	53	0	0%	0.246	2,540	--	--	0.049	--	53	100%
2006 PSE II														
VOC	1,2,3-Trichloropropane	mg/kg	1	155	0	1%	0.0055	0.7	410	410	0.017	1	137	88%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	155	0	0%	0.011	260	--	--	0.0054	--	155	100%
VOC	1,2-Dibromoethane	mg/kg	--	155	0	0%	0.011	260	--	--	0.06	--	60	39%
VOC	trans-1,4-Dichloro-2-butene	mg/kg	--	1	0	0%	0.063	0.063	--	--	0.0069	--	1	100%
VOC	Trichloroethene (TCE)	mg/kg	--	155	0	0%	0.0055	100	--	--	0.057	--	64	41%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	162	0	0%	0.25	230	--	--	0.61	--	144	89%
SVOC	3,3'-Dichlorobenzidine	mg/kg	1	162	0	1%	0.1	180	0.029	0.029	1.1	--	143	88%
SVOC	bis-(2-Chloroethyl)ether	mg/kg	--	162	0	0%	0.05	38	--	--	0.33	--	140	86%
SVOC	Hexachlorobenzene	mg/kg	--	162	0	0%	0.01	38	--	--	0.15	--	144	89%
SVOC	Hexachlorocyclopentadiene	mg/kg	--	29	0	0%	0.899	7	--	--	0.2	--	29	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	133	0	0%	0.25	38	--	--	0.016	--	133	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	2	162	0	1%	0.025	38	0.26	0.28	0.052	2	142	88%
PAH	Benzo(a)pyrene	mg/kg	6	162	0	4%	0.01	38	0.0094	2.8	0.049	3	141	87%
PAH	Dibenzo(a,h)anthracene	mg/kg	2	162	0	1%	0.01	38	0.091	3.5	0.049	2	142	88%
2007 Excavation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	82	0	0%	0.0011	4.5	--	--	0.0054	--	71	87%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	81	0	0%	2	29	--	--	0.61	--	81	100%
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	81	0	0%	1.6	23	--	--	1.1	--	81	100%
SVOC	bis-(2-Chloroethyl)ether	mg/kg	2	81	0	2%	0.33	4.7	0.046	0.054	0.33	--	78	96%
SVOC	Hexachlorobenzene	mg/kg	2	81	0	2%	0.34	4.7	0.056	0.11	0.15	--	79	98%
SVOC	n-Nitrosodimethylamine	mg/kg	1	81	0	1%	0.33	4.7	0.061	0.061	0.016	1	80	99%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	2	81	0	2%	0.34	4.7	0.04	0.06	0.052	1	79	98%
PAH	Benzo(a)pyrene	mg/kg	38	108	0	35%	0.005	4.7	0.00045	0.1	0.049	2	41	38%
PAH	Dibenzo(a,h)anthracene	mg/kg	23	108	0	21%	0.005	4.7	0.00021	0.099	0.049	2	41	38%

TABLE 3-5

Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Soil Samples)

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL	Percent ND > PSL
2007 RI														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	204	0	0%	0.00082	0.2	--	--	0.0054	--	184	90%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	210	0	0%	1.8	41	--	--	0.61	--	210	100%
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	211	0	0%	1.5	33	--	--	1.1	--	211	100%
SVOC	bis-(2-Chloroethyl)ether	mg/kg	1	211	0	0%	0.3	6.8	0.033	0.033	0.33	--	182	86%
SVOC	Hexachlorobenzene	mg/kg	2	211	0	1%	0.3	6.8	0.045	0.091	0.15	--	209	99%
SVOC	n-Nitrosodimethylamine	mg/kg	--	211	0	0%	0.3	6.8	--	--	0.016	--	211	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	1	211	0	0%	0.3	6.8	0.041	0.041	0.052	--	210	100%
PAH	Benzo(a)pyrene	mg/kg	18	221	0	8%	0.0048	2.3	0.00054	0.17	0.049	1	90	41%
PAH	Dibenzo(a,h)anthracene	mg/kg	14	221	0	6%	0.0048	1.6	0.00027	0.055	0.049	1	98	44%
2008 Excavation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	3	216	0	1%	0.009	0.61	0.18	0.26	0.0054	3	213	99%
SVOC	n-Nitrosodimethylamine	mg/kg	--	206	0	0%	0.026	2	--	--	0.016	--	206	100%
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	2	55	0	4%	0.5	56	10	50	3.1	2	46	84%
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	7	0	0%	10	50	--	--	6.1	--	7	100%
2008 RI														
VOC	1,2,3-Trichloropropane	mg/kg	3	92	0	3%	0.0048	0.083	0.0013	0.26	0.017	2	77	84%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	92	0	0%	0.0095	0.33	--	--	0.0054	--	92	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	85	0	0%	0.045	0.1	--	--	0.016	--	85	100%
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	92	0	0%	0.56	54	--	--	3.1	--	83	90%
Taku Gardens - 2009 Bldg 11 Confirmation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	18	0	0%	0.00798	0.0146	--	--	0.0054	--	18	100%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	18	0	0%	2.1	2.33	--	--	0.61	--	18	100%
SVOC	Hexachlorobenzene	mg/kg	--	18	0	0%	0.263	0.291	--	--	0.15	--	18	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	18	0	0%	0.263	0.291	--	--	0.016	--	18	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	18	0	0%	0.263	0.291	--	--	0.052	--	18	100%
Taku Gardens - 2009 Bldg 15 Confirmation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	39	0	0%	0.00621	0.132	--	--	0.0054	--	39	100%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	39	0	0%	2.02	2.53	--	--	0.61	--	39	100%
SVOC	Hexachlorobenzene	mg/kg	--	39	0	0%	0.253	0.316	--	--	0.15	--	39	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	39	0	0%	0.253	0.316	--	--	0.016	--	39	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	39	0	0%	0.253	0.316	--	--	0.052	--	39	100%
Taku Gardens - 2009 Bldg 49 Confirmation														
VOC	1,2,3-Trichloropropane	mg/kg	--	3	0	0%	0.009	0.0597	--	--	0.017	--	2	67%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	3	0	0%	0.011	0.018	--	--	0.0054	--	3	100%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	3	0	0%	2.1	2.19	--	--	0.61	--	3	100%
SVOC	Hexachlorobenzene	mg/kg	--	3	0	0%	0.262	0.274	--	--	0.15	--	3	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	3	0	0%	0.262	0.274	--	--	0.016	--	3	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	3	0	0%	0.262	0.274	--	--	0.052	--	3	100%
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	3	0	0%	9.1	10	--	--	3.1	--	3	100%
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	3	0	0%	9.1	10	--	--	6.1	--	3	100%
Taku Gardens - 2009 Bldg 9 Confirmation														
VOC	1,2,3-Trichloropropane	mg/kg	--	11	0	0%	0.028	0.101	--	--	0.017	--	11	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	11	0	0%	0.12	0.203	--	--	0.0054	--	11	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	11	0	0%	0.026	0.54	--	--	0.016	--	11	100%

TABLE 3-5
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Soil Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL	Percent ND > PSL
Taku Gardens - 2009 MW Installation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	12	0	0%	0.0059	0.018	--	--	0.0054	--	12	100%
Taku Gardens - 2009 PCB Confirmation														
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	9	0	0%	0.00815	0.0184	--	--	0.0054	--	9	100%
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	9	0	0%	2.33	2.66	--	--	0.61	--	9	100%
SVOC	Hexachlorobenzene	mg/kg	--	9	0	0%	0.292	0.318	--	--	0.15	--	9	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	9	0	0%	0.292	0.318	--	--	0.016	--	9	100%
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	9	0	0%	0.292	0.318	--	--	0.052	--	9	100%
Taku Gardens - 2009 Surface Soil														
VOC	1,2,3-Trichloropropane	mg/kg	--	8	0	0%	0.043	0.081	--	--	0.017	--	8	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	8	0	0%	0.18	0.33	--	--	0.0054	--	8	100%
SVOC	n-Nitrosodimethylamine	mg/kg	--	8	0	0%	0.026	0.034	--	--	0.016	--	8	100%
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	8	0	0%	10	10	--	--	3.1	--	8	100%
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	8	0	0%	10	10	--	--	6.1	--	8	100%
Taku Gardens - 2009 TCE Delineation														
VOC	1,2,3-Trichloropropane	mg/kg	--	26	0	0%	0.0504	0.0822	--	--	0.017	--	26	100%
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	26	0	0%	0.101	0.164	--	--	0.0054	--	26	100%

Notes:

mg/kg = milligrams per kilogram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semivolatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

TABLE 3-6

Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
2005 Northwind														
VOC	1,1,2,2-Tetrachloroethane	µg/L	--	15	0	0%	0.5	0.5	--	--	0.43	--	15	100%
VOC	1,1,2-Trichloroethane	µg/L	--	15	0	0%	1	1	--	--	0.5	--	15	100%
VOC	1,1-Dichloroethene	µg/L	--	15	0	0%	1	1	--	--	0.7	--	15	100%
VOC	1,2,3-Trichloropropane	µg/L	--	15	0	0%	1	1	--	--	0.012	--	15	100%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	15	0	0%	2	2	--	--	0.00032	--	15	100%
VOC	1,2-Dibromoethane	µg/L	--	15	0	0%	1	1	--	--	0.005	--	15	100%
VOC	1,2-Dichloropropane	µg/L	--	15	0	0%	1	1	--	--	0.5	--	15	100%
VOC	2-Hexanone	µg/L	--	15	0	0%	10	10	--	--	4.7	--	15	100%
VOC	Carbon tetrachloride	µg/L	--	15	0	0%	1	1	--	--	0.5	--	15	100%
VOC	Hexachlorobutadiene	µg/L	--	15	0	0%	1	1	--	--	0.72	--	15	100%
VOC	Methylene chloride	µg/L	--	15	0	0%	5	5	--	--	0.5	--	15	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	15	0	0%	1	1	--	--	0.5	--	15	100%
VOC	Trichloroethene (TCE)	µg/L	--	15	0	0%	1	1	--	--	0.5	--	15	100%
VOC	Vinyl chloride	µg/L	--	15	0	0%	1	1	--	--	0.2	--	15	100%
TPH	DRO	µg/L	5	15	0	33%	300	500	68.2	528,000	150	3	10	67%
TPH	RRO	µg/L	--	12	0	0%	500	500	--	--	110	--	12	100%
SVOC	1,2-Diphenylhydrazine	µg/L	--	6	0	0%	10	10	--	--	0.084	--	6	100%
SVOC	2,4,6-Trichlorophenol	µg/L	--	15	0	0%	10	100	--	--	7.7	--	15	100%
SVOC	2,4-Dinitrophenol	µg/L	--	15	0	0%	50	700	--	--	7.3	--	15	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	15	0	0%	50	500	--	--	0.37	--	15	100%
SVOC	2-Nitroaniline	µg/L	--	15	0	0%	10	100	--	--	37	--	8	53%
SVOC	3&4-Methylphenol	µg/L	--	15	0	0%	10	200	--	--	18	--	9	60%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	15	0	0%	10	100	--	--	0.19	--	15	100%
SVOC	4-Chloroaniline	µg/L	--	15	0	0%	10	100	--	--	1.6	--	15	100%
SVOC	Azobenzene	µg/L	--	9	0	0%	10	100	--	--	0.12	--	9	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	15	0	0%	10	100	--	--	0.077	--	15	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	15	0	0%	10	100	--	--	0.32	--	15	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	15	0	0%	10	100	--	--	0.6	--	15	100%
SVOC	Dibenzofuran	µg/L	--	15	0	0%	10	100	--	--	7.3	--	15	100%
SVOC	Hexachlorobenzene	µg/L	--	15	0	0%	10	100	--	--	0.1	--	15	100%
SVOC	Hexachlorocyclopentadiene	µg/L	--	15	0	0%	10	300	--	--	5	--	15	100%
SVOC	Hexachloroethane	µg/L	--	15	0	0%	10	100	--	--	4	--	15	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	15	0	0%	10	100	--	--	0.0017	--	15	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	15	0	0%	10	100	--	--	0.012	--	15	100%
SVOC	Pentachlorophenol	µg/L	--	15	0	0%	50	500	--	--	0.1	--	15	100%
PESTICIDES	Aldrin	µg/L	--	12	0	0%	0.05	0.051	--	--	0.005	--	12	100%
PESTICIDES	alpha-BHC	µg/L	--	12	0	0%	0.03	0.031	--	--	0.014	--	12	100%
PESTICIDES	beta-BHC	µg/L	--	12	0	0%	0.1	0.1	--	--	0.047	--	12	100%
PESTICIDES	Dieldrin	µg/L	--	12	0	0%	0.03	0.031	--	--	0.0053	--	12	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	12	0	0%	0.03	0.031	--	--	0.02	--	12	100%
PESTICIDES	Heptachlor	µg/L	--	12	0	0%	0.1	0.1	--	--	0.04	--	12	100%
PESTICIDES	Heptachlor epoxide	µg/L	--	12	0	0%	0.03	0.031	--	--	0.02	--	12	100%
PESTICIDES	Toxaphene	µg/L	--	12	0	0%	1	1	--	--	0.3	--	12	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.0068	--	15	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.0068	--	15	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.034	--	15	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.034	--	15	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.034	--	15	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	15	0	0%	0.1	0.11	--	--	0.034	--	15	100%
PAH	Benzo(a)anthracene	µg/L	--	15	0	0%	10	100	--	--	0.12	--	15	100%
PAH	Benzo(a)pyrene	µg/L	--	15	0	0%	10	100	--	--	0.02	--	15	100%
PAH	Benzo(b)fluoranthene	µg/L	--	15	0	0%	10	100	--	--	0.12	--	15	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
PAH	Benzo(k)fluoranthene	µg/L	--	15	0	0%	10	100	--	--	1.2	--	15	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	15	0	0%	10	100	--	--	0.012	--	15	100%
PAH	Indeno(1,2,3-cd)pyrene	µg/L	--	15	0	0%	10	100	--	--	0.12	--	15	100%
METALS	Antimony	µg/L	4	12	0	33%	1	1	0.325	1.42	0.6	1	8	67%
METALS	Beryllium	µg/L	--	12	0	0%	1	1	--	--	0.4	--	12	100%
METALS	Selenium	µg/L	6	12	0	50%	10	10	3.8	9.61	5	4	6	50%
METALS	Thallium	µg/L	1	12	0	8%	1	1	0.607	0.607	0.2	1	11	92%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	15	0	0%	10	100	--	--	0.13	--	15	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	15	0	0%	10	100	--	--	0.13	--	15	100%
EXPLOSIVES	Nitrobenzene	µg/L	--	15	0	0%	10	100	--	--	1.8	--	15	100%
2006 PSE II														
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	13	0	0%	1	1	--	--	0.52	--	13	100%
VOC	1,1,2,2-Tetrachloroethane	µg/L	1	13	0	8%	1	1	0.82	0.82	0.43	1	12	92%
VOC	1,1,2-Trichloroethane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	1,1-Dichloroethene	µg/L	1	13	0	8%	1	1	0.5	0.5	0.7	--	12	92%
VOC	1,2,3-Trichloropropane	µg/L	1	13	0	8%	1	1	0.45	0.45	0.012	1	12	92%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	13	0	0%	2	2	--	--	0.00032	--	13	100%
VOC	1,2-Dibromoethane	µg/L	--	13	0	0%	2	2	--	--	0.005	--	13	100%
VOC	1,2-Dichloroethane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	1,2-Dichloropropane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Benzene	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Carbon tetrachloride	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Hexachlorobutadiene	µg/L	--	13	0	0%	1	1	--	--	0.72	--	13	100%
VOC	Methylene chloride	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Trichloroethene (TCE)	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Vinyl chloride	µg/L	--	13	0	0%	1	1	--	--	0.2	--	13	100%
TPH	RRO	µg/L	1	13	0	8%	300	3,400	120	120	110	1	12	92%
SVOC	2,4,6-Trichlorophenol	µg/L	--	13	0	0%	9.7	11	--	--	7.7	--	13	100%
SVOC	2,4-Dinitrophenol	µg/L	--	13	0	0%	58	64	--	--	7.3	--	13	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	13	0	0%	58	64	--	--	0.37	--	13	100%
SVOC	2-Nitroaniline	µg/L	--	13	0	0%	48	53	--	--	37	--	13	100%
SVOC	3&4-Methylphenol	µg/L	--	13	0	0%	29	32	--	--	18	--	13	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	13	0	0%	48	53	--	--	0.19	--	13	100%
SVOC	4-Chloroaniline	µg/L	--	13	0	0%	9.7	11	--	--	1.6	--	13	100%
SVOC	Azobenzene	µg/L	--	13	0	0%	9.7	11	--	--	0.12	--	13	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	13	0	0%	9.7	11	--	--	0.077	--	13	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	13	0	0%	9.7	11	--	--	0.32	--	13	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	13	0	0%	9.7	11	--	--	0.6	--	13	100%
SVOC	Carbazole	µg/L	--	13	0	0%	9.7	11	--	--	4.3	--	13	100%
SVOC	Dibenzofuran	µg/L	--	13	0	0%	9.7	11	--	--	7.3	--	13	100%
SVOC	Hexachlorobenzene	µg/L	--	13	0	0%	9.7	11	--	--	0.1	--	13	100%
SVOC	Hexachloroethane	µg/L	--	13	0	0%	9.7	11	--	--	4	--	13	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	13	0	0%	15	16	--	--	0.0017	--	13	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	13	0	0%	9.7	11	--	--	0.012	--	13	100%
SVOC	Pentachlorophenol	µg/L	--	13	0	0%	58	64	--	--	0.1	--	13	100%
PESTICIDES	Aldrin	µg/L	--	13	0	0%	0.05	0.25	--	--	0.005	--	13	100%
PESTICIDES	alpha-BHC	µg/L	--	13	0	0%	0.05	0.25	--	--	0.014	--	13	100%
PESTICIDES	beta-BHC	µg/L	--	13	0	0%	0.05	0.25	--	--	0.047	--	13	100%
PESTICIDES	Dieldrin	µg/L	1	13	0	8%	0.1	0.5	0.0082	0.0082	0.0053	1	12	92%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	13	0	0%	0.05	0.25	--	--	0.02	--	13	100%
PESTICIDES	Heptachlor	µg/L	--	13	0	0%	0.05	0.25	--	--	0.04	--	13	100%
PESTICIDES	Heptachlor epoxide	µg/L	1	13	0	8%	0.05	0.25	0.0031	0.0031	0.02	--	12	92%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
PESTICIDES	Toxaphene	µg/L	--	13	0	0%	2	10	--	--	0.3	--	13	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.0068	--	3	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.0068	--	3	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.034	--	3	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.034	--	3	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.034	--	3	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	3	0	0%	0.098	0.1	--	--	0.034	--	3	100%
PAH	Benzo(a)anthracene	µg/L	--	13	0	0%	9.7	11	--	--	0.12	--	13	100%
PAH	Benzo(a)pyrene	µg/L	--	13	0	0%	9.7	11	--	--	0.02	--	13	100%
PAH	Benzo(b)fluoranthene	µg/L	--	13	0	0%	9.7	11	--	--	0.12	--	13	100%
PAH	Benzo(k)fluoranthene	µg/L	--	13	0	0%	9.7	11	--	--	1.2	--	13	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	13	0	0%	9.7	11	--	--	0.012	--	13	100%
PAH	Indeno(1,2,3-cd)pyrene	µg/L	--	13	0	0%	15	16	--	--	0.12	--	13	100%
METALS	Antimony	µg/L	--	13	0	0%	6	6	--	--	0.6	--	13	100%
METALS	Beryllium	µg/L	--	13	0	0%	1	1	--	--	0.4	--	13	100%
METALS	Cobalt	µg/L	7	13	0	54%	3	3	1.5	9.6	1.1	7	6	46%
METALS	Mercury	µg/L	--	13	0	0%	0.3	0.3	--	--	0.2	--	13	100%
METALS	Thallium	µg/L	--	13	0	0%	1.5	1.5	--	--	0.2	--	13	100%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	1	13	0	8%	0.1	10	0.65	0.65	0.13	1	5	38%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	1	13	0	8%	0.1	10	3.1	3.1	0.13	1	5	38%
EXPLOSIVES	2-Nitrotoluene	µg/L	--	10	0	0%	0.5	5	--	--	0.37	--	10	100%
2007 Fall GW														
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	73	0	0%	1	1	--	--	0.52	--	73	100%
VOC	1,1,2,2-Tetrachloroethane	µg/L	2	73	0	3%	1	1	0.14	7.4	0.43	1	71	97%
VOC	1,1,2-Trichloroethane	µg/L	2	73	0	3%	1	1	0.47	0.89	0.5	1	71	97%
VOC	1,1-Dichloroethene	µg/L	3	73	0	4%	1	1	0.37	0.9	0.7	1	70	96%
VOC	1,2,3-Trichloropropane	µg/L	1	73	0	1%	1	1	0.54	0.54	0.012	1	72	99%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	73	0	0%	2	2	--	--	0.00032	--	73	100%
VOC	1,2-Dibromoethane	µg/L	--	73	0	0%	1	2	--	--	0.005	--	73	100%
VOC	1,2-Dichloroethane	µg/L	1	73	0	1%	1	1	0.27	0.27	0.5	--	72	99%
VOC	1,2-Dichloropropane	µg/L	--	73	0	0%	1	1	--	--	0.5	--	73	100%
VOC	2-Hexanone	µg/L	1	73	0	1%	2	5	1.1	1.1	4.7	--	26	36%
VOC	Benzene	µg/L	--	73	0	0%	1	1	--	--	0.5	--	73	100%
VOC	Carbon tetrachloride	µg/L	--	73	0	0%	1	1	--	--	0.5	--	73	100%
VOC	Hexachlorobutadiene	µg/L	--	73	0	0%	1	9.7	--	--	0.72	--	73	100%
VOC	Methylene chloride	µg/L	--	73	0	0%	1	1	--	--	0.5	--	73	100%
VOC	Tetrachloroethene (PCE)	µg/L	2	73	0	3%	1	1	0.13	0.16	0.5	--	71	97%
VOC	Trichloroethene (TCE)	µg/L	8	73	0	11%	1	1	0.081	14	0.5	5	65	89%
VOC	Vinyl chloride	µg/L	--	73	0	0%	1	1	--	--	0.2	--	73	100%
TPH	RRO	µg/L	35	73	0	48%	300	3,000	33	270	110	13	38	52%
SVOC	2,4,6-Trichlorophenol	µg/L	--	73	0	0%	9.5	11	--	--	7.7	--	73	100%
SVOC	2,4-Dinitrophenol	µg/L	--	73	0	0%	57	67	--	--	7.3	--	73	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	73	0	0%	57	67	--	--	0.37	--	73	100%
SVOC	2-Nitroaniline	µg/L	--	73	0	0%	48	56	--	--	37	--	73	100%
SVOC	3&4-Methylphenol	µg/L	--	73	0	0%	28	34	--	--	18	--	73	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	73	0	0%	48	56	--	--	0.19	--	73	100%
SVOC	4-Chloroaniline	µg/L	--	53	0	0%	9.5	11	--	--	1.6	--	53	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	73	0	0%	9.5	11	--	--	0.077	--	73	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	73	0	0%	9.5	11	--	--	0.32	--	73	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	73	0	0%	9.5	11	--	--	0.6	--	73	100%
SVOC	Carbazole	µg/L	--	73	0	0%	9.5	11	--	--	4.3	--	73	100%
SVOC	Dibenzofuran	µg/L	--	73	0	0%	9.5	11	--	--	7.3	--	73	100%
SVOC	Hexachlorobenzene	µg/L	--	73	0	0%	9.5	11	--	--	0.1	--	73	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
SVOC	Hexachloroethane	µg/L	--	73	0	0%	9.5	11	--	--	4	--	73	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	73	0	0%	14	17	--	--	0.0017	--	73	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	73	0	0%	9.5	11	--	--	0.012	--	73	100%
SVOC	Pentachlorophenol	µg/L	--	73	0	0%	0.24	61	--	--	0.1	--	73	100%
PESTICIDES	Aldrin	µg/L	1	73	0	1%	0.047	11	0.0025	0.0025	0.005	--	72	99%
PESTICIDES	alpha-BHC	µg/L	--	73	0	0%	0.047	11	--	--	0.014	--	73	100%
PESTICIDES	beta-BHC	µg/L	--	73	0	0%	0.047	11	--	--	0.047	--	72	99%
PESTICIDES	Dieldrin	µg/L	--	73	0	0%	0.094	22	--	--	0.0053	--	73	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	73	0	0%	0.047	11	--	--	0.02	--	73	100%
PESTICIDES	Heptachlor	µg/L	4	73	0	5%	0.047	11	0.0051	0.012	0.04	--	69	95%
PESTICIDES	Heptachlor epoxide	µg/L	--	73	0	0%	0.047	11	--	--	0.02	--	73	100%
PESTICIDES	Toxaphene	µg/L	--	73	0	0%	1.9	430	--	--	0.3	--	73	100%
PCBs	PCB-1016 (Aroclor 1016)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.96	--	12	92%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	13	0	0%	1.4	1.7	--	--	0.0068	--	13	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.0068	--	13	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.034	--	13	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.034	--	13	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.034	--	13	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	13	0	0%	0.94	1.1	--	--	0.034	--	13	100%
PCBs	PCBs (total)	µg/L	--	13	0	0%	1	1.205	--	--	0.17	--	13	100%
PAH	Benzo(a)pyrene	µg/L	1	73	0	1%	0.048	10	0.02	0.02	0.02	--	72	99%
PAH	Dibenzo(a,h)anthracene	µg/L	1	73	0	1%	0.048	10	0.028	0.028	0.012	1	72	99%
METALS	Antimony	µg/L	6	73	0	8%	2	6	0.35	3.4	0.6	3	67	92%
METALS	Beryllium	µg/L	--	73	0	0%	1	2	--	--	0.4	--	73	100%
METALS	Mercury	µg/L	--	73	0	0%	0.2	0.3	--	--	0.2	--	63	86%
METALS	Thallium	µg/L	1	73	0	1%	1.5	2	0.6	0.6	0.2	1	72	99%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	73	0	0%	0.21	11	--	--	0.13	--	73	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	73	0	0%	0.21	11	--	--	0.13	--	73	100%
2007 Spring GW														
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	13	0	0%	1	1	--	--	0.52	--	13	100%
VOC	1,1,2,2-Tetrachloroethane	µg/L	--	13	0	0%	1	1	--	--	0.43	--	13	100%
VOC	1,1,2-Trichloroethane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	1,1-Dichloroethene	µg/L	1	13	0	8%	1	1	1.1	1.1	0.7	1	12	92%
VOC	1,2,3-Trichloropropane	µg/L	--	13	0	0%	1	1	--	--	0.012	--	13	100%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	13	0	0%	2	2	--	--	0.00032	--	13	100%
VOC	1,2-Dibromoethane	µg/L	--	13	0	0%	2	2	--	--	0.005	--	13	100%
VOC	1,2-Dichloroethane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	1,2-Dichloropropane	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Benzene	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Carbon tetrachloride	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Hexachlorobutadiene	µg/L	--	13	0	0%	1	1	--	--	0.72	--	13	100%
VOC	Methylene chloride	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Trichloroethene (TCE)	µg/L	--	13	0	0%	1	1	--	--	0.5	--	13	100%
VOC	Vinyl chloride	µg/L	--	13	0	0%	1	1	--	--	0.2	--	13	100%
TPH	RRO	µg/L	2	13	0	15%	280	1,500	99	150	110	1	11	85%
SVOC	2,4,6-Trichlorophenol	µg/L	--	13	0	0%	9.6	10	--	--	7.7	--	13	100%
SVOC	2,4-Dinitrophenol	µg/L	--	13	0	0%	58	61	--	--	7.3	--	13	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	13	0	0%	58	61	--	--	0.37	--	13	100%
SVOC	2-Nitroaniline	µg/L	--	13	0	0%	48	50	--	--	37	--	13	100%
SVOC	3&4-Methylphenol	µg/L	--	13	0	0%	29	30	--	--	18	--	13	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	13	0	0%	48	50	--	--	0.19	--	13	100%
SVOC	4-Chloroaniline	µg/L	--	13	0	0%	9.6	10	--	--	1.6	--	13	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
SVOC	Azobenzene	µg/L	--	13	0	0%	9.6	10	--	--	0.12	--	13	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	13	0	0%	9.6	10	--	--	0.077	--	13	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	13	0	0%	9.6	10	--	--	0.32	--	13	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	13	0	0%	9.6	10	--	--	0.6	--	13	100%
SVOC	Carbazole	µg/L	--	13	0	0%	9.6	10	--	--	4.3	--	13	100%
SVOC	Dibenzofuran	µg/L	--	13	0	0%	9.6	10	--	--	7.3	--	13	100%
SVOC	Hexachlorobenzene	µg/L	--	13	0	0%	9.6	10	--	--	0.1	--	13	100%
SVOC	Hexachloroethane	µg/L	--	13	0	0%	9.6	10	--	--	4	--	13	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	13	0	0%	14	15	--	--	0.0017	--	13	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	13	0	0%	9.6	10	--	--	0.012	--	13	100%
SVOC	Pentachlorophenol	µg/L	--	13	0	0%	0.24	61	--	--	0.1	--	13	100%
PESTICIDES	Aldrin	µg/L	--	13	0	0%	0.048	1	--	--	0.005	--	13	100%
PESTICIDES	alpha-BHC	µg/L	--	13	0	0%	0.048	1	--	--	0.014	--	13	100%
PESTICIDES	beta-BHC	µg/L	--	13	0	0%	0.048	1	--	--	0.047	--	13	100%
PESTICIDES	Dieldrin	µg/L	--	13	0	0%	0.095	2.1	--	--	0.0053	--	13	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	13	0	0%	0.048	1	--	--	0.02	--	13	100%
PESTICIDES	Heptachlor	µg/L	2	13	0	15%	0.048	1	0.13	0.14	0.04	2	11	85%
PESTICIDES	Heptachlor epoxide	µg/L	--	13	0	0%	0.048	1	--	--	0.02	--	13	100%
PESTICIDES	Toxaphene	µg/L	--	13	0	0%	2	42	--	--	0.3	--	13	100%
PCBs	PCB-1016 (Aroclor 1016)	µg/L	--	13	0	0%	0.98	1	--	--	0.96	--	13	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	13	0	0%	1.5	1.5	--	--	0.0068	--	13	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	13	0	0%	0.98	1	--	--	0.0068	--	13	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	13	0	0%	0.98	1	--	--	0.034	--	13	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	13	0	0%	0.98	1	--	--	0.034	--	13	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	13	0	0%	0.98	1	--	--	0.034	--	13	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	13	0	0%	0.98	1	--	--	0.034	--	13	100%
PCBs	PCBs (total)	µg/L	--	13	0	0%	0.8	0.85	--	--	0.17	--	13	100%
PAH	Benzo(a)anthracene	µg/L	--	13	0	0%	9.6	10	--	--	0.12	--	13	100%
PAH	Benzo(a)pyrene	µg/L	--	13	0	0%	9.6	10	--	--	0.02	--	13	100%
PAH	Benzo(b)fluoranthene	µg/L	--	13	0	0%	9.6	10	--	--	0.12	--	13	100%
PAH	Benzo(k)fluoranthene	µg/L	--	13	0	0%	9.6	10	--	--	1.2	--	13	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	13	0	0%	9.6	10	--	--	0.012	--	13	100%
PAH	Indeno(1,2,3-cd)pyrene	µg/L	--	13	0	0%	14	15	--	--	0.12	--	13	100%
METALS	Antimony	µg/L	--	13	0	0%	6	6	--	--	0.6	--	13	100%
METALS	Beryllium	µg/L	--	13	0	0%	1	1	--	--	0.4	--	13	100%
METALS	Cobalt	µg/L	6	13	0	46%	3	3	1	11	1.1	5	7	54%
METALS	Mercury	µg/L	--	13	0	0%	0.3	0.3	--	--	0.2	--	13	100%
METALS	Thallium	µg/L	--	13	0	0%	1.5	1.5	--	--	0.2	--	13	100%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	1	13	0	8%	0.14	10	1	1	0.13	1	12	92%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	13	0	0%	0.14	10	--	--	0.13	--	13	100%
EXPLOSIVES	2-Nitrotoluene	µg/L	1	10	0	10%	0.21	0.52	0.15	0.15	0.37	--	5	50%
2008 Fall GW														
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	34	0	0%	1	10	--	--	0.52	--	34	100%
VOC	1,1,2-Trichloroethane	µg/L	1	34	0	3%	1	10	0.63	0.63	0.5	1	33	97%
VOC	1,1-Dichloroethene	µg/L	9	34	0	26%	1	10	0.16	3.8	0.7	3	25	74%
VOC	1,2,3-Trichloropropane	µg/L	3	34	0	9%	0.05	0.5	0.26	1	0.012	3	31	91%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	34	0	0%	2	20	--	--	0.00032	--	34	100%
VOC	1,2-Dibromoethane	µg/L	--	34	0	0%	2	20	--	--	0.005	--	34	100%
VOC	1,2-Dichloroethane	µg/L	--	34	0	0%	1	10	--	--	0.5	--	34	100%
VOC	1,2-Dichloropropane	µg/L	--	34	0	0%	1	10	--	--	0.5	--	34	100%
VOC	Benzene	µg/L	--	34	0	0%	1	10	--	--	0.5	--	34	100%
VOC	Carbon tetrachloride	µg/L	--	34	0	0%	1	10	--	--	0.5	--	34	100%
VOC	Hexachlorobutadiene	µg/L	--	34	0	0%	1	11	--	--	0.72	--	34	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
VOC	Methylene chloride	µg/L	--	34	0	0%	1	10	--	--	0.5	--	34	100%
VOC	Tetrachloroethene (PCE)	µg/L	2	34	0	6%	1	10	0.13	1	0.5	1	32	94%
TPH	RRO	µg/L	7	34	0	21%	310	15,000	100	150	110	4	27	79%
SVOC	2,4,6-Trichlorophenol	µg/L	--	31	0	0%	10	51	--	--	7.7	--	31	100%
SVOC	2,4-Dinitrophenol	µg/L	--	28	0	0%	60	310	--	--	7.3	--	28	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	28	0	0%	60	310	--	--	0.37	--	28	100%
SVOC	2-Nitroaniline	µg/L	--	34	0	0%	50	260	--	--	37	--	34	100%
SVOC	3&4-Methylphenol	µg/L	--	31	0	0%	30	150	--	--	18	--	31	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	34	0	0%	50	250	--	--	0.19	--	34	100%
SVOC	4-Chloroaniline	µg/L	--	34	0	0%	10	51	--	--	1.6	--	34	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	34	0	0%	10	51	--	--	0.077	--	34	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	34	0	0%	10	51	--	--	0.32	--	34	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	6	34	0	18%	10	50	2.4	2.7	0.6	6	28	82%
SVOC	Carbazole	µg/L	--	34	0	0%	10	50	--	--	4.3	--	34	100%
SVOC	Dibenzofuran	µg/L	--	34	0	0%	10	50	--	--	7.3	--	34	100%
SVOC	Hexachlorobenzene	µg/L	--	34	0	0%	10	51	--	--	0.1	--	34	100%
SVOC	Hexachloroethane	µg/L	--	34	0	0%	10	51	--	--	4	--	34	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	34	0	0%	15	76	--	--	0.0017	--	34	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	34	0	0%	10	51	--	--	0.012	--	34	100%
PESTICIDES	Aldrin	µg/L	--	34	0	0%	0.05	0.51	--	--	0.005	--	34	100%
PESTICIDES	alpha-BHC	µg/L	--	34	0	0%	0.05	0.51	--	--	0.014	--	34	100%
PESTICIDES	beta-BHC	µg/L	--	34	0	0%	0.05	0.51	--	--	0.047	--	34	100%
PESTICIDES	Dieldrin	µg/L	1	34	0	3%	0.099	1	0.063	0.063	0.0053	1	33	97%
PESTICIDES	gamma-BHC (Lindane)	µg/L	1	34	0	3%	0.05	0.51	0.03	0.03	0.02	1	33	97%
PESTICIDES	Heptachlor	µg/L	1	34	0	3%	0.05	0.51	0.16	0.16	0.04	1	33	97%
PESTICIDES	Heptachlor epoxide	µg/L	--	34	0	0%	0.05	0.51	--	--	0.02	--	34	100%
PESTICIDES	Toxaphene	µg/L	--	34	0	0%	2	20	--	--	0.3	--	34	100%
PCBs	PCB-1016 (Aroclor 1016)	µg/L	--	3	0	0%	1	1.1	--	--	0.96	--	3	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	3	0	0%	1.6	1.6	--	--	0.0068	--	3	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	3	0	0%	1	1.1	--	--	0.0068	--	3	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	3	0	0%	1	1.1	--	--	0.034	--	3	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	3	0	0%	1	1.1	--	--	0.034	--	3	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	3	0	0%	1	1.1	--	--	0.034	--	3	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	3	0	0%	1	1.1	--	--	0.034	--	3	100%
PCBs	PCBs (total)	µg/L	--	3	0	0%	1.11	1.145	--	--	0.17	--	3	100%
PAH	Benzo(a)pyrene	µg/L	--	34	0	0%	0.05	11	--	--	0.02	--	34	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	34	0	0%	0.05	11	--	--	0.012	--	34	100%
METALS	Antimony	µg/L	2	34	0	6%	6	6	2.6	3.8	0.6	2	32	94%
METALS	Beryllium	µg/L	--	34	0	0%	1	1	--	--	0.4	--	34	100%
METALS	Cobalt	µg/L	22	34	0	65%	3	3	1.1	23.4	1.1	21	12	35%
METALS	Mercury	µg/L	--	34	0	0%	0.3	0.3	--	--	0.2	--	34	100%
METALS	Thallium	µg/L	--	34	0	0%	1.5	1.5	--	--	0.2	--	34	100%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	34	0	0%	0.21	11	--	--	0.13	--	34	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	34	0	0%	0.21	11	--	--	0.13	--	34	100%
2008 Spring GW														
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	28	0	0%	1	1	--	--	0.52	--	28	100%
VOC	1,1,2-Trichloroethane	µg/L	--	28	0	0%	1	1	--	--	0.5	--	28	100%
VOC	1,1-Dichloroethene	µg/L	3	28	0	11%	1	1	0.15	0.99	0.7	1	25	89%
VOC	1,2,3-Trichloropropane	µg/L	8	28	0	29%	0.05	0.05	0.016	0.59	0.012	8	20	71%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	28	0	0%	2	2	--	--	0.00032	--	28	100%
VOC	1,2-Dibromoethane	µg/L	--	28	0	0%	2	2	--	--	0.005	--	28	100%
VOC	1,2-Dichloroethane	µg/L	2	28	0	7%	1	1	0.11	0.37	0.5	--	26	93%
VOC	1,2-Dichloropropane	µg/L	--	28	0	0%	1	1	--	--	0.5	--	28	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
VOC	Benzene	µg/L	4	28	0	14%	1	1	0.17	2.6	0.5	1	24	86%
VOC	Carbon tetrachloride	µg/L	--	28	0	0%	1	1	--	--	0.5	--	28	100%
VOC	Hexachlorobutadiene	µg/L	--	28	0	0%	1	11	--	--	0.72	--	28	100%
VOC	Methylene chloride	µg/L	--	28	0	0%	1	1	--	--	0.5	--	28	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	28	0	0%	1	1	--	--	0.5	--	28	100%
TPH	RRO	µg/L	2	28	0	7%	300	7,000	99	100	110	--	26	93%
SVOC	2,4,6-Trichlorophenol	µg/L	--	28	0	0%	9.5	11	--	--	7.7	--	28	100%
SVOC	2,4-Dinitrophenol	µg/L	--	28	0	0%	57	68	--	--	7.3	--	28	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	28	0	0%	57	68	--	--	0.37	--	28	100%
SVOC	2-Nitroaniline	µg/L	--	28	0	0%	48	57	--	--	37	--	28	100%
SVOC	3&4-Methylphenol	µg/L	--	28	0	0%	28	34	--	--	18	--	28	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	28	0	0%	48	57	--	--	0.19	--	28	100%
SVOC	4-Chloroaniline	µg/L	--	28	0	0%	9.5	11	--	--	1.6	--	28	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	28	0	0%	9.5	11	--	--	0.077	--	28	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	28	0	0%	9.5	11	--	--	0.32	--	28	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	28	0	0%	9.5	11	--	--	0.6	--	28	100%
SVOC	Carbazole	µg/L	--	28	0	0%	9.5	11	--	--	4.3	--	28	100%
SVOC	Dibenzofuran	µg/L	--	28	0	0%	9.5	11	--	--	7.3	--	28	100%
SVOC	Hexachlorobenzene	µg/L	--	28	0	0%	9.5	11	--	--	0.1	--	28	100%
SVOC	Hexachloroethane	µg/L	--	28	0	0%	9.5	11	--	--	4	--	28	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	28	0	0%	14	17	--	--	0.0017	--	28	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	28	0	0%	9.5	11	--	--	0.012	--	28	100%
PESTICIDES	Aldrin	µg/L	--	28	0	0%	0.048	0.26	--	--	0.005	--	28	100%
PESTICIDES	alpha-BHC	µg/L	--	28	0	0%	0.048	0.26	--	--	0.014	--	28	100%
PESTICIDES	beta-BHC	µg/L	--	28	0	0%	0.048	0.26	--	--	0.047	--	28	100%
PESTICIDES	Dieldrin	µg/L	--	28	0	0%	0.096	0.51	--	--	0.0053	--	28	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	28	0	0%	0.048	0.26	--	--	0.02	--	28	100%
PESTICIDES	Heptachlor	µg/L	2	28	0	7%	0.048	0.25	0.2	0.3	0.04	2	26	93%
PESTICIDES	Heptachlor epoxide	µg/L	--	28	0	0%	0.048	0.26	--	--	0.02	--	28	100%
PESTICIDES	Toxaphene	µg/L	--	28	0	0%	1.9	10	--	--	0.3	--	28	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	3	0	0%	0.14	1.6	--	--	0.0068	--	3	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	3	0	0%	0.09	1	--	--	0.0068	--	3	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	3	0	0%	0.09	1	--	--	0.034	--	3	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	3	0	0%	0.09	1	--	--	0.034	--	3	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	3	0	0%	0.09	1	--	--	0.034	--	3	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	3	0	0%	0.09	1	--	--	0.034	--	3	100%
PCBs	PCBs (total)	µg/L	--	3	0	0%	0.0955	1.11	--	--	0.17	--	2	67%
PAH	Benzo(a)pyrene	µg/L	1	28	0	4%	0.048	2.6	0.028	0.028	0.02	1	27	96%
PAH	Dibenzo(a,h)anthracene	µg/L	1	28	0	4%	0.048	2.6	0.033	0.033	0.012	1	27	96%
METALS	Antimony	µg/L	1	28	0	4%	6	6	3.1	3.1	0.6	1	27	96%
METALS	Beryllium	µg/L	--	28	0	0%	1	1	--	--	0.4	--	28	100%
METALS	Cobalt	µg/L	17	28	0	61%	3	3	1.1	22.8	1.1	15	11	39%
METALS	Mercury	µg/L	--	28	0	0%	0.3	0.3	--	--	0.2	--	28	100%
METALS	Thallium	µg/L	1	28	0	4%	1.5	1.5	0.58	0.58	0.2	1	27	96%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	28	0	0%	0.21	10	--	--	0.13	--	28	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	28	0	0%	0.21	10	--	--	0.13	--	28	100%
Taku Gardens - 2009 Fall GWM														
VOC	1,1,2-Trichloroethane	µg/L	1	33	0	3%	1	1	0.45	0.45	0.5	--	32	97%
VOC	1,1-Dichloroethene	µg/L	--	33	0	0%	1	1	--	--	0.7	--	33	100%
VOC	1,2,3-Trichloropropane	µg/L	5	33	0	15%	0.05	1	0.017	1.2	0.012	5	28	85%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	33	0	0%	2	2	--	--	0.00032	--	33	100%
VOC	1,2-Dibromoethane	µg/L	--	33	0	0%	1	1	--	--	0.005	--	33	100%
VOC	1,2-Dichloropropane	µg/L	--	33	0	0%	1	1	--	--	0.5	--	33	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
VOC	2-Hexanone	µg/L	--	33	0	0%	10	10	--	--	4.7	--	33	100%
VOC	Carbon tetrachloride	µg/L	--	33	0	0%	1	1	--	--	0.5	--	33	100%
VOC	Hexachlorobutadiene	µg/L	--	36	0	0%	1	10.6	--	--	0.72	--	36	100%
VOC	Methylene chloride	µg/L	--	33	0	0%	5	5	--	--	0.5	--	33	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	33	0	0%	1	1	--	--	0.5	--	33	100%
TPH	DRO	µg/L	5	33	0	15%	714	816	271	13,000	150	5	28	85%
TPH	RRO	µg/L	2	33	0	6%	446	1,100	257	1,490	110	2	31	94%
SVOC	2,4,6-Trichlorophenol	µg/L	--	33	0	0%	10	11.1	--	--	7.7	--	33	100%
SVOC	2,4-Dinitrophenol	µg/L	--	33	0	0%	50	55.6	--	--	7.3	--	33	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	33	0	0%	50	55.6	--	--	0.37	--	33	100%
SVOC	3&4-Methylphenol	µg/L	--	33	0	0%	20	22.2	--	--	18	--	33	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	33	0	0%	10	11.1	--	--	0.19	--	33	100%
SVOC	4-Chloroaniline	µg/L	--	33	0	0%	10	11.1	--	--	1.6	--	33	100%
SVOC	Azobenzene	µg/L	--	33	0	0%	10	11.1	--	--	0.12	--	33	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	33	0	0%	10	11.1	--	--	0.077	--	33	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	33	0	0%	10	11.1	--	--	0.32	--	33	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	33	0	0%	10	11.1	--	--	0.6	--	33	100%
SVOC	Carbazole	µg/L	--	33	0	0%	10	11.1	--	--	4.3	--	33	100%
SVOC	Dibenzofuran	µg/L	--	33	0	0%	10	11.1	--	--	7.3	--	33	100%
SVOC	Hexachlorobenzene	µg/L	--	33	0	0%	10	11.1	--	--	0.1	--	33	100%
SVOC	Hexachloroethane	µg/L	--	33	0	0%	10	11.1	--	--	4	--	33	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	33	0	0%	10	11.1	--	--	0.0017	--	33	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	33	0	0%	10	11.1	--	--	0.012	--	33	100%
SVOC	Pentachlorophenol	µg/L	--	33	0	0%	50	55.6	--	--	0.1	--	33	100%
PESTICIDES	Aldrin	µg/L	--	33	0	0%	0.03	0.0328	--	--	0.005	--	33	100%
PESTICIDES	alpha-BHC	µg/L	--	33	0	0%	0.03	0.0328	--	--	0.014	--	33	100%
PESTICIDES	Dieldrin	µg/L	--	33	0	0%	0.03	0.0328	--	--	0.0053	--	33	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	33	0	0%	0.03	0.0328	--	--	0.02	--	33	100%
PESTICIDES	Heptachlor epoxide	µg/L	--	33	0	0%	0.03	0.0328	--	--	0.02	--	33	100%
PESTICIDES	Toxaphene	µg/L	--	33	0	0%	1	1.09	--	--	0.3	--	33	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.0068	--	4	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.0068	--	4	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.034	--	4	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.034	--	4	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.034	--	4	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	4	0	0%	0.105	0.109	--	--	0.034	--	4	100%
PAH	Benzo(a)pyrene	µg/L	--	33	0	0%	0.05	10.7	--	--	0.02	--	33	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	33	0	0%	0.05	10.7	--	--	0.012	--	33	100%
METALS	Antimony	µg/L	3	33	0	9%	1	1	0.62	1.76	0.6	3	30	91%
METALS	Beryllium	µg/L	--	33	0	0%	1	1	--	--	0.4	--	33	100%
METALS	Thallium	µg/L	--	33	0	0%	2.5	2.5	--	--	0.2	--	33	100%
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	µg/L	--	33	0	0%	100	530	--	--	3.7	--	33	100%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	33	0	0%	0.2	11.1	--	--	0.13	--	33	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	33	0	0%	0.2	11.1	--	--	0.13	--	33	100%
Taku Gardens - 2009 MW Installation (123-TCP investigations)														
VOC	1,1,2-Trichloroethane	µg/L	--	9	0	0%	1	1	--	--	0.5	--	9	100%
VOC	1,1-Dichloroethene	µg/L	--	9	0	0%	1	1	--	--	0.7	--	9	100%
VOC	1,2,3-Trichloropropane	µg/L	--	9	0	0%	0.05	0.05	--	--	0.012	--	9	100%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	9	0	0%	2	2	--	--	0.00032	--	9	100%
VOC	1,2-Dibromoethane	µg/L	--	9	0	0%	1	1	--	--	0.005	--	9	100%
VOC	1,2-Dichloropropane	µg/L	--	9	0	0%	1	1	--	--	0.5	--	9	100%
VOC	2-Hexanone	µg/L	--	9	0	0%	10	10	--	--	4.7	--	9	100%
VOC	Carbon tetrachloride	µg/L	--	9	0	0%	1	1	--	--	0.5	--	9	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
VOC	Hexachlorobutadiene	µg/L	--	9	0	0%	1	1	--	--	0.72	--	9	100%
VOC	Methylene chloride	µg/L	--	9	0	0%	5	5	--	--	0.5	--	9	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	9	0	0%	1	1	--	--	0.5	--	9	100%
TPH	DRO	µg/L	--	3	0	0%	833	860	--	--	150	--	3	100%
PAH	Benzo(a)pyrene	µg/L	--	6	0	0%	0.0478	0.0546	--	--	0.02	--	6	100%
PAH	Dibenzo(a,h)anthracene	µg/L	--	6	0	0%	0.0478	0.0546	--	--	0.012	--	6	100%
Taku Gardens - 2009 Spring GWM														
VOC	1,1,2-Trichloroethane	µg/L	--	34	0	0%	1	1	--	--	0.5	--	34	100%
VOC	1,1-Dichloroethene	µg/L	--	34	0	0%	1	1	--	--	0.7	--	34	100%
VOC	1,2,3-Trichloropropane	µg/L	4	34	0	12%	0.05	1	0.024	0.51	0.012	4	30	88%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	34	0	0%	2	2	--	--	0.00032	--	34	100%
VOC	1,2-Dibromoethane	µg/L	--	34	0	0%	1	1	--	--	0.005	--	34	100%
VOC	1,2-Dichloropropane	µg/L	--	34	0	0%	1	1	--	--	0.5	--	34	100%
VOC	2-Hexanone	µg/L	--	34	0	0%	10	10	--	--	4.7	--	34	100%
VOC	Carbon tetrachloride	µg/L	--	34	0	0%	1	1	--	--	0.5	--	34	100%
VOC	Hexachlorobutadiene	µg/L	--	34	0	0%	1	1	--	--	0.72	--	34	100%
VOC	Methylene chloride	µg/L	--	34	0	0%	5	5	--	--	0.5	--	34	100%
VOC	Tetrachloroethene (PCE)	µg/L	1	34	0	3%	1	1	0.43	0.43	0.5	--	33	97%
TPH	DRO	µg/L	6	34	0	18%	741	870	350	13,200	150	6	28	82%
TPH	RRO	µg/L	5	34	0	15%	463	947	322	1,120	110	5	29	85%
SVOC	2,4,6-Trichlorophenol	µg/L	--	33	0	0%	9.26	217	--	--	7.7	--	33	100%
SVOC	2,4-Dinitrophenol	µg/L	--	33	0	0%	46.3	1,090	--	--	7.3	--	33	100%
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	33	0	0%	46.3	1,090	--	--	0.37	--	33	100%
SVOC	3&4-Methylphenol	µg/L	--	33	0	0%	18.5	435	--	--	18	--	33	100%
SVOC	3,3'-Dichlorobenzidine	µg/L	--	33	0	0%	9.26	217	--	--	0.19	--	33	100%
SVOC	4-Chloroaniline	µg/L	--	33	0	0%	9.26	217	--	--	1.6	--	33	100%
SVOC	Azobenzene	µg/L	--	33	0	0%	9.26	217	--	--	0.12	--	33	100%
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	33	0	0%	9.26	217	--	--	0.077	--	33	100%
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	33	0	0%	9.26	217	--	--	0.32	--	33	100%
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	--	33	0	0%	9.26	217	--	--	0.6	--	33	100%
SVOC	Carbazole	µg/L	--	33	0	0%	9.26	217	--	--	4.3	--	33	100%
SVOC	Dibenzofuran	µg/L	--	33	0	0%	9.26	217	--	--	7.3	--	33	100%
SVOC	Hexachlorobenzene	µg/L	--	33	0	0%	9.26	217	--	--	0.1	--	33	100%
SVOC	Hexachloroethane	µg/L	--	33	0	0%	9.26	217	--	--	4	--	33	100%
SVOC	n-Nitrosodimethylamine	µg/L	--	33	0	0%	9.26	217	--	--	0.0017	--	33	100%
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	33	0	0%	9.26	217	--	--	0.012	--	33	100%
SVOC	Pentachlorophenol	µg/L	--	33	0	0%	46.3	1,090	--	--	0.1	--	33	100%
PESTICIDES	Aldrin	µg/L	--	34	0	0%	0.0278	0.0349	--	--	0.005	--	34	100%
PESTICIDES	alpha-BHC	µg/L	--	34	0	0%	0.0278	0.0349	--	--	0.014	--	34	100%
PESTICIDES	Dieldrin	µg/L	--	34	0	0%	0.0278	0.0349	--	--	0.0053	--	34	100%
PESTICIDES	gamma-BHC (Lindane)	µg/L	--	34	0	0%	0.0278	0.0349	--	--	0.02	--	34	100%
PESTICIDES	Heptachlor epoxide	µg/L	--	34	0	0%	0.0278	0.0349	--	--	0.02	--	34	100%
PESTICIDES	Toxaphene	µg/L	--	34	0	0%	0.926	1.16	--	--	0.3	--	34	100%
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.0068	--	6	100%
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.0068	--	6	100%
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.034	--	6	100%
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.034	--	6	100%
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.034	--	6	100%
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	6	0	0%	0.103	0.11	--	--	0.034	--	6	100%
PAH	Benzo(a)pyrene	µg/L	1	33	0	3%	0.05	0.0595	0.0385	0.0385	0.02	1	32	97%
PAH	Dibenzo(a,h)anthracene	µg/L	1	33	0	3%	0.05	0.0595	0.0787	0.0787	0.012	1	32	97%
METALS	Antimony	µg/L	2	34	0	6%	1	3.61	0.321	1.31	0.6	1	32	94%
METALS	Beryllium	µg/L	--	34	0	0%	1	1	--	--	0.4	--	34	100%

TABLE 3-6
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Groundwater Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Groundwater	Number of Detects > Groundwater	Number of Nondetects > Groundwater	Percent ND > PSL
METALS	Thallium	µg/L	--	34	0	0%	2.5	2.5	--	--	0.2	--	34	100%
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	µg/L	2	34	0	6%	100	530	67	250	3.7	2	32	94%
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	34	0	0%	0.2	11.1	--	--	0.13	--	34	100%
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	34	0	0%	0.2	11.1	--	--	0.13	--	34	100%
Taku Gardens - 2009 TCE Delineation														
VOC	1,1,2-Trichloroethane	µg/L	--	17	0	0%	1	1	--	--	0.5	--	17	100%
VOC	1,1-Dichloroethene	µg/L	--	17	0	0%	1	1	--	--	0.7	--	17	100%
VOC	1,2,3-Trichloropropane	µg/L	--	17	0	0%	0.05	1	--	--	0.012	--	17	100%
VOC	1,2-Dibromo-3-chloropropane	µg/L	--	17	0	0%	2	2	--	--	0.00032	--	17	100%
VOC	1,2-Dibromoethane	µg/L	--	17	0	0%	1	1	--	--	0.005	--	17	100%
VOC	1,2-Dichloropropane	µg/L	--	17	0	0%	1	1	--	--	0.5	--	17	100%
VOC	2-Hexanone	µg/L	--	17	0	0%	10	10	--	--	4.7	--	17	100%
VOC	Carbon tetrachloride	µg/L	--	17	0	0%	1	1	--	--	0.5	--	17	100%
VOC	Hexachlorobutadiene	µg/L	--	17	0	0%	1	1	--	--	0.72	--	17	100%
VOC	Methylene chloride	µg/L	--	17	0	0%	5	5	--	--	0.5	--	17	100%
VOC	Tetrachloroethene (PCE)	µg/L	--	17	0	0%	1	1	--	--	0.5	--	17	100%
TPH	DRO	µg/L	10	17	0	59%	773	899	295	3,630	150	10	7	41%

Notes:

MDLs support groundwater cleanup levels because the PSLs are adjusted Method 2 CULs and RSL that correspond to a cancer risk of 10-6 and HQ of 1.0,

µg/L = micrograms per liter

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semivolatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

TABLE 3-7
Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Soil Gas Samples)
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil Gas PSL	Number of Detects > PSL	Number of Nondetects > PSL	Percent ND > PSL
2007 Fall Vapor														
VOC	1,1,2,2-Tetrachloroethane	$\mu g/m^3$	--	159	0	0	14	5,200	--	--	0.42	--	159	100%
VOC	1,1,2-Trichloroethane	$\mu g/m^3$	--	159	0	0	11	4,100	--	--	1.5	--	159	100%
VOC	1,1-Dichloroethene	$\mu g/m^3$	18	159	0	11%	7.9	2,900	4.1	200	0.49	18	141	89%
VOC	1,2,3-Trichloropropane	$\mu g/m^3$	--	159	0	0	12	4,500	--	--	0.012	--	159	100%
VOC	1,2,4-Trichlorobenzene	$\mu g/m^3$	--	159	0	0	37	14,000	--	--	4.2	--	159	100%
VOC	1,2,4-Trimethylbenzene	$\mu g/m^3$	8	159	0	5%	15	5,600	22	75	7.3	8	151	95%
VOC	1,2-Dibromoethane	$\mu g/m^3$	--	159	0	0	15	5,600	--	--	0.041	--	159	100%
VOC	1,2-Dichloroethane	$\mu g/m^3$	--	159	0	0	8.1	3,000	--	--	0.94	--	159	100%
VOC	1,2-Dichloropropane	$\mu g/m^3$	--	159	0	0	14	5,200	--	--	1.3	--	159	100%
VOC	1,3,5-Trimethylbenzene	$\mu g/m^3$	10	159	0	6%	15	5,600	9.2	28	7.3	10	149	94%
VOC	1,4-Dichlorobenzene	$\mu g/m^3$	--	159	0	0	36	13,000	--	--	3.5	--	159	100%
VOC	Benzene	$\mu g/m^3$	11	159	0	7%	9.6	3,600	6.3	160	3.1	11	148	93%
VOC	Bromodichloromethane	$\mu g/m^3$	--	159	0	0	13	4,800	--	--	1.4	--	159	100%
VOC	Bromoform	$\mu g/m^3$	--	159	0	0	21	7,800	--	--	22	--	75	47%
VOC	Bromomethane	$\mu g/m^3$	7	159	0	4%	16	6,000	13	34	5.2	7	152	96%
VOC	Carbon tetrachloride	$\mu g/m^3$	--	159	0	0	13	4,800	--	--	1.6	--	159	100%
VOC	Chloroform	$\mu g/m^3$	18	159	0	11%	9.7	3,600	4.9	170	1.1	18	141	89%
VOC	Chloromethane	$\mu g/m^3$	--	159	0	0	8.2	3,000	--	--	14	--	68	43%
VOC	Dibromochloromethane	$\mu g/m^3$	--	159	0	0	17	6,300	--	--	1	--	159	100%
VOC	Dibromomethane	$\mu g/m^3$	--	159	0	0	21	7,800	--	--	37	--	68	43%
VOC	Hexachlorobutadiene	$\mu g/m^3$	--	159	0	0	43	16,000	--	--	1.11	--	159	100%
VOC	Tetrachloroethene (PCE)	$\mu g/m^3$	4	159	0	3%	14	5,200	16	300	4.1	4	155	97%
VOC	Trichloroethene (TCE)	$\mu g/m^3$	1	159	0	1%	11	4,100	61	61	0.22	1	158	99%
VOC	Vinyl chloride	$\mu g/m^3$	--	159	0	0	7.7	2,900	--	--	0.81	--	159	100%
PAH	Naphthalene	$\mu g/m^3$	--	159	0	0	31	12,000	--	--	0.72	--	159	100%
2008 Fall Vapor														
VOC	1,2,3-Trichloropropane	$\mu g/m^3$	1	10	0	10%	4	4.8	170	170	0.012	1	9	90%
VOC	1,2,4-Trichlorobenzene	$\mu g/m^3$	1	10	0	10%	5	6	2.7	2.7	4.2	--	9	90%
VOC	1,2-Dibromoethane	$\mu g/m^3$	--	10	0	0	1	1.2	--	--	0.041	--	10	100%
VOC	Dibromochloromethane	$\mu g/m^3$	--	10	0	0	1.1	1.4	--	--	1	--	10	100%
PAH	Naphthalene	$\mu g/m^3$	1	10	0	10%	3.5	4.2	1.5	1.5	0.72	1	9	90%

TABLE 3-7

Data Usability Evaluation by Investigation - Analytes with >35% MDLs in Excess of PSL (Soil Gas Samples)

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte Name	Units	Number of Detects	Number of Samples	Number of rejected samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil Gas PSL	Number of Detects > PSL	Number of Nondetects > PSL	Percent ND > PSL
2008 December Vapor														
VOC	1,2,3-Trichloropropane	$\mu g/m^3$	1	111	0	1%	4	7.5	1	1	0.012	1	110	99%
VOC	1,2,4-Trichlorobenzene	$\mu g/m^3$	4	111	0	4%	5	9.2	1.3	7.5	4.2	1	107	96%
VOC	1,2-Dibromoethane	$\mu g/m^3$	--	111	0	0	1	1.9	--	--	0.041	--	111	100%
VOC	Dibromochloromethane	$\mu g/m^3$	1	111	0	1%	1.1	2.1	0.27	0.27	1	--	110	99%
PAH	Naphthalene	$\mu g/m^3$	9	111	0	8%	3.5	4.9	0.098	12	0.72	7	102	92%
Taku Gardens SubSlab Soil Gas August 2009														
VOC	1,2,3-Trichloropropane	$\mu g/m^3$	--	59	0	0	4.1	4.8	--	--	0.012	--	59	100%
VOC	1,2,4-Trichlorobenzene	$\mu g/m^3$	--	59	0	0	5	5.9	--	--	4.2	--	59	100%
VOC	1,2-Dibromoethane	$\mu g/m^3$	--	59	0	0	1	1.2	--	--	0.041	--	59	100%
VOC	Dibromochloromethane	$\mu g/m^3$	--	59	0	0	1.2	1.3	--	--	1	--	59	100%
PAH	Naphthalene	$\mu g/m^3$	4	60	0	7%	3.6	4.1	1.2	2.7	0.72	4	56	93%

Notes:

$\mu g/m^3$ = micrograms per cubic meter of air

VOC = volatile organic compounds

PAH = polynuclear aromatic hydrocarbons

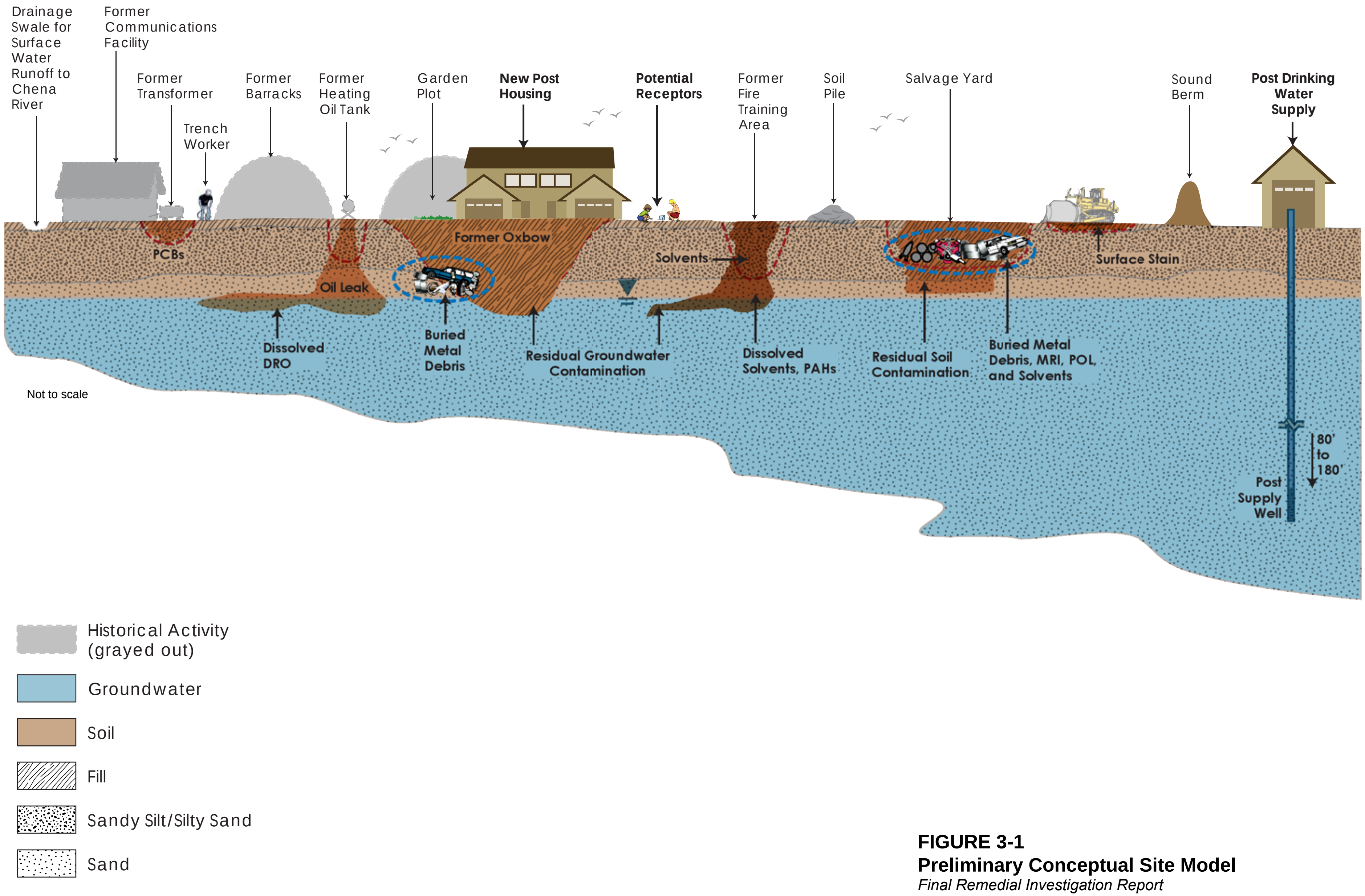


FIGURE 3-1
Preliminary Conceptual Site Model
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

357465.B1.06_ES042009002SEA . Fig.3-1_PrelimConceptualSiteModel.ai . 10/27/10

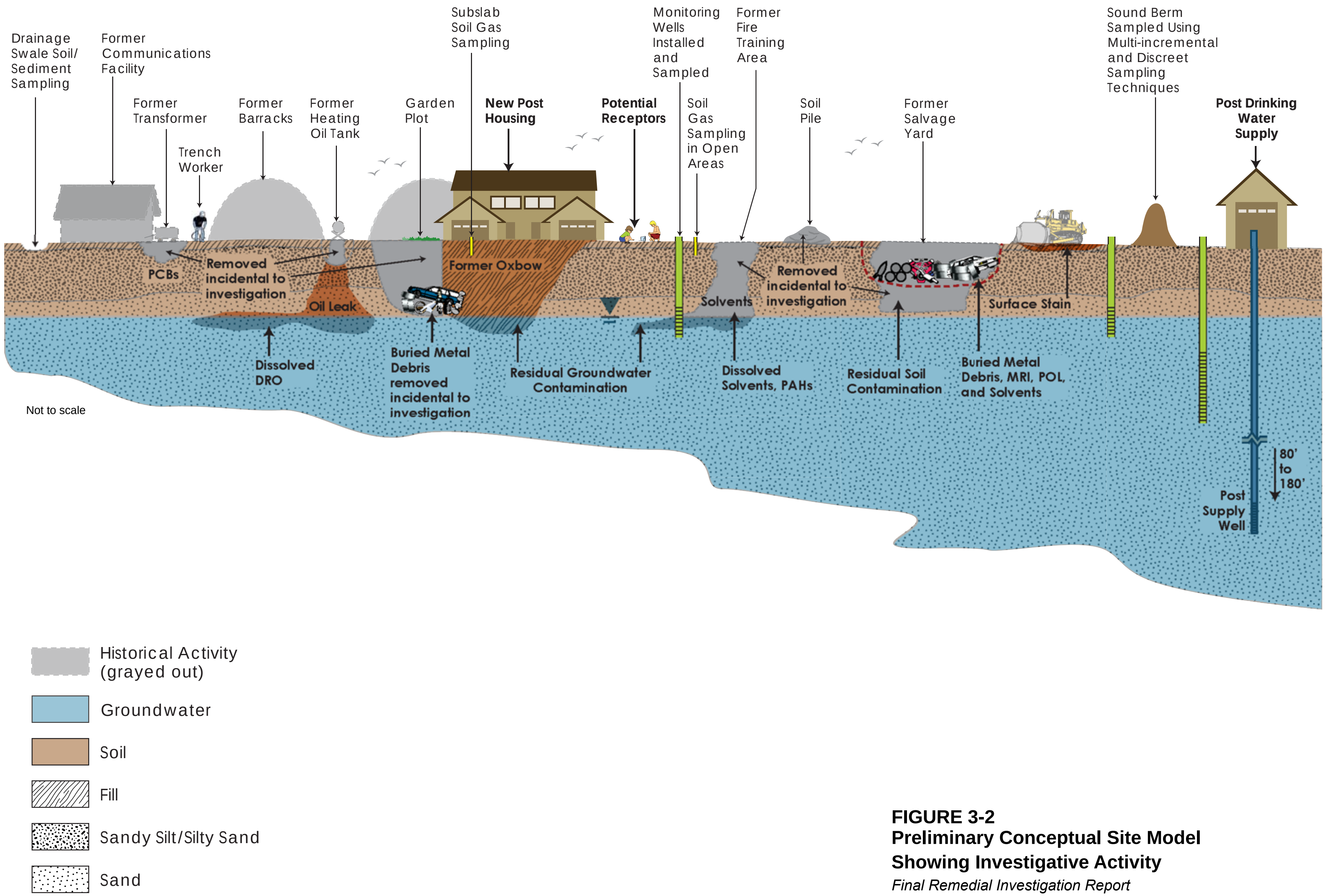


FIGURE 3-2
Preliminary Conceptual Site Model Showing Investigative Activity
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

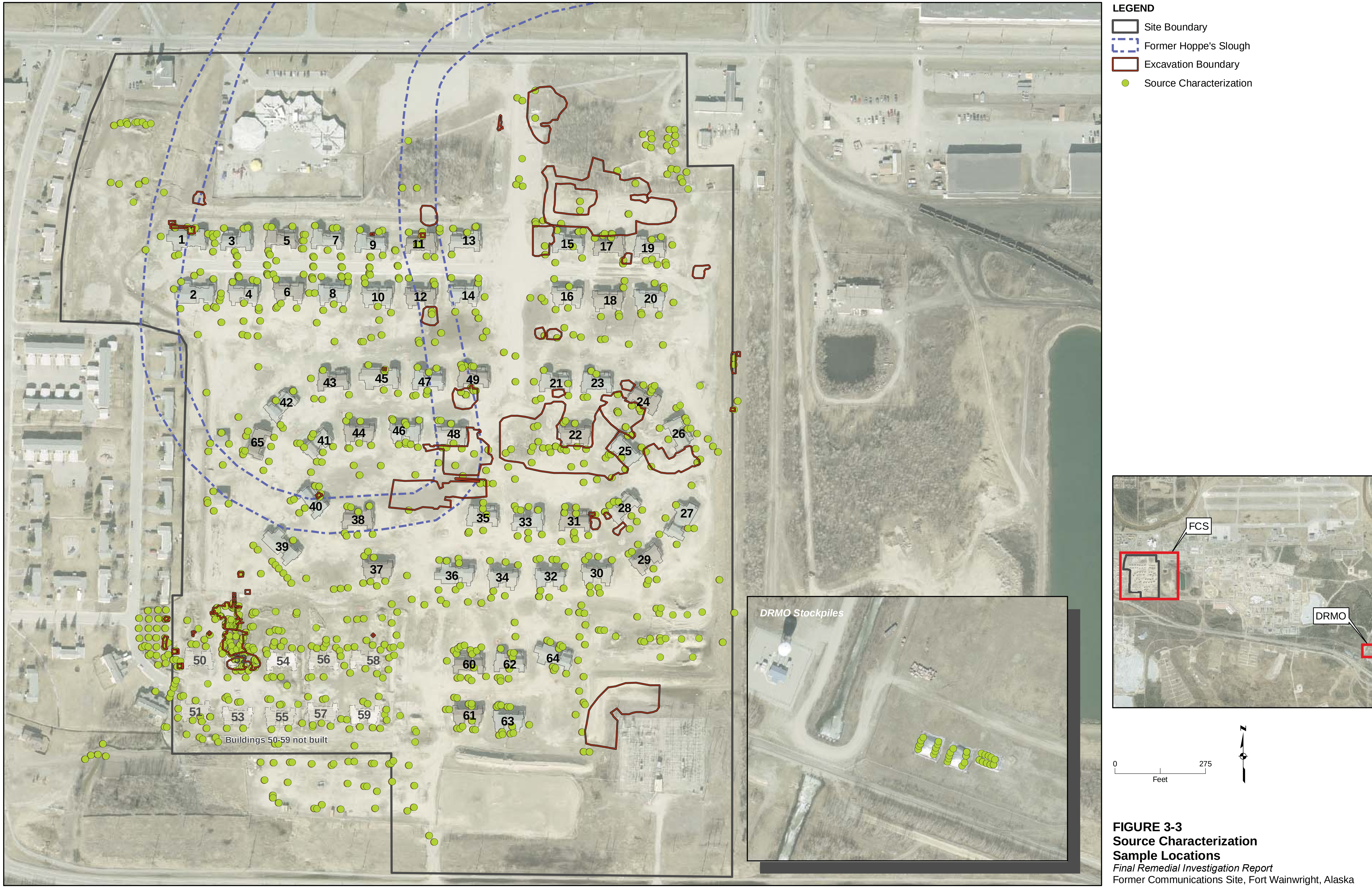
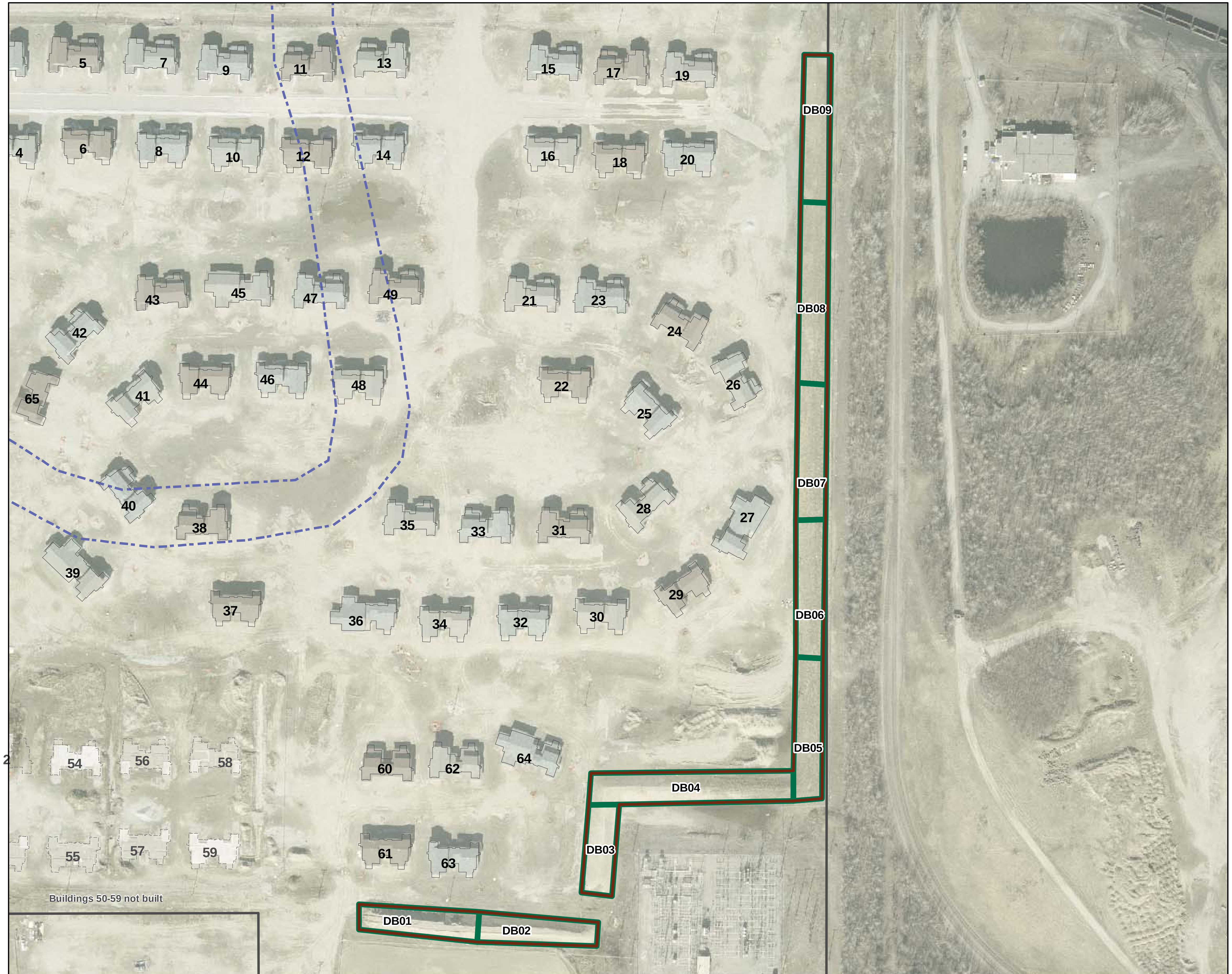


FIGURE 3-3
Source Characterization Sample Locations
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



LEGEND

Site Boundary

Former Hoppe's Slough

Sound Berm

Multi Incremental Decision Unit Boundary

0 275 Feet

N

FIGURE 3-4

2007 Sound Berm Sample Locations

Final Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_SAMPLELOCATIONSOTHER_2007SOUNDBERM.MXD RGRABARE 3/25/2010

CH2MHILL

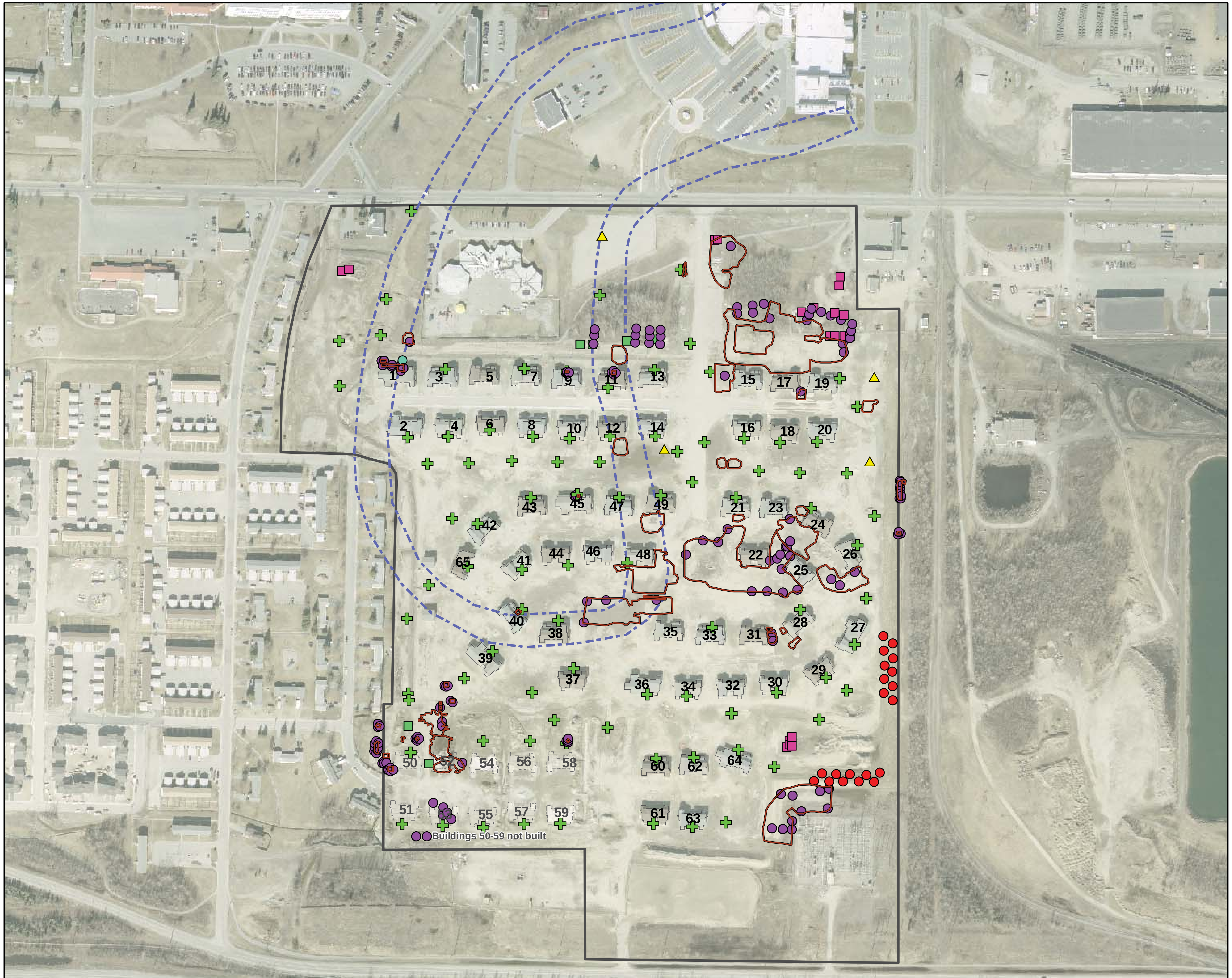
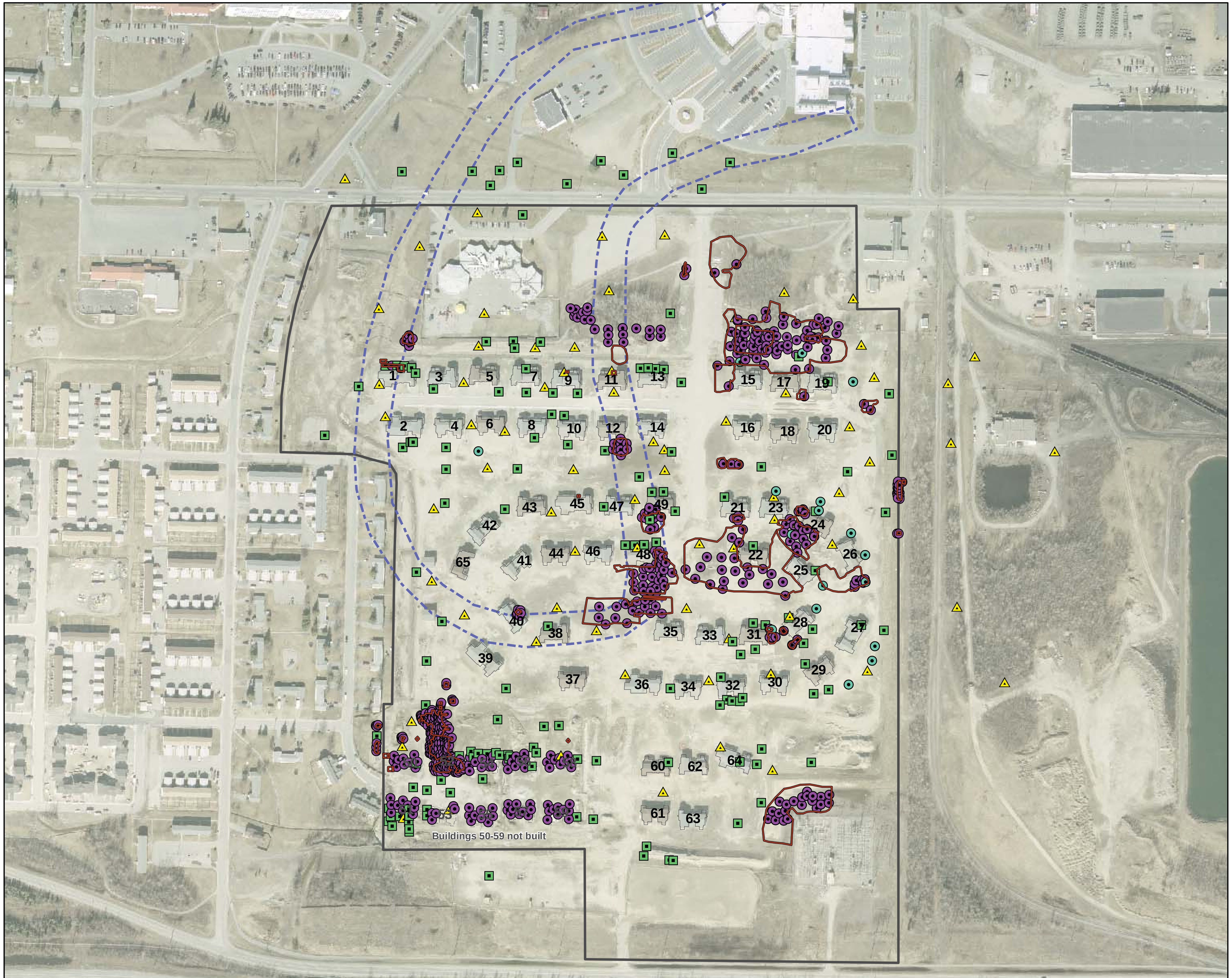


FIGURE 3-5
Surface Soil Samples Used in Nature and Extent and Risk Evaluations
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_SAMPLES.MXD RGRABARE 3/12/2010

CH2MHILL



LEGEND

- Site Boundary
- Former Hoppe's Slough
- Excavation Boundary

Location Type

- Soil Boring Sample Location
- Excavation Confirmation Sample Location
- Test Pit Sample Location
- MW Boring Sample Location

0 275
Feet

FIGURE 3-6
Subsurface Soil Samples Used in Nature and Extent and Risk Evaluations
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_SAMPLES.MXD RGRABARE 3/12/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Location Type

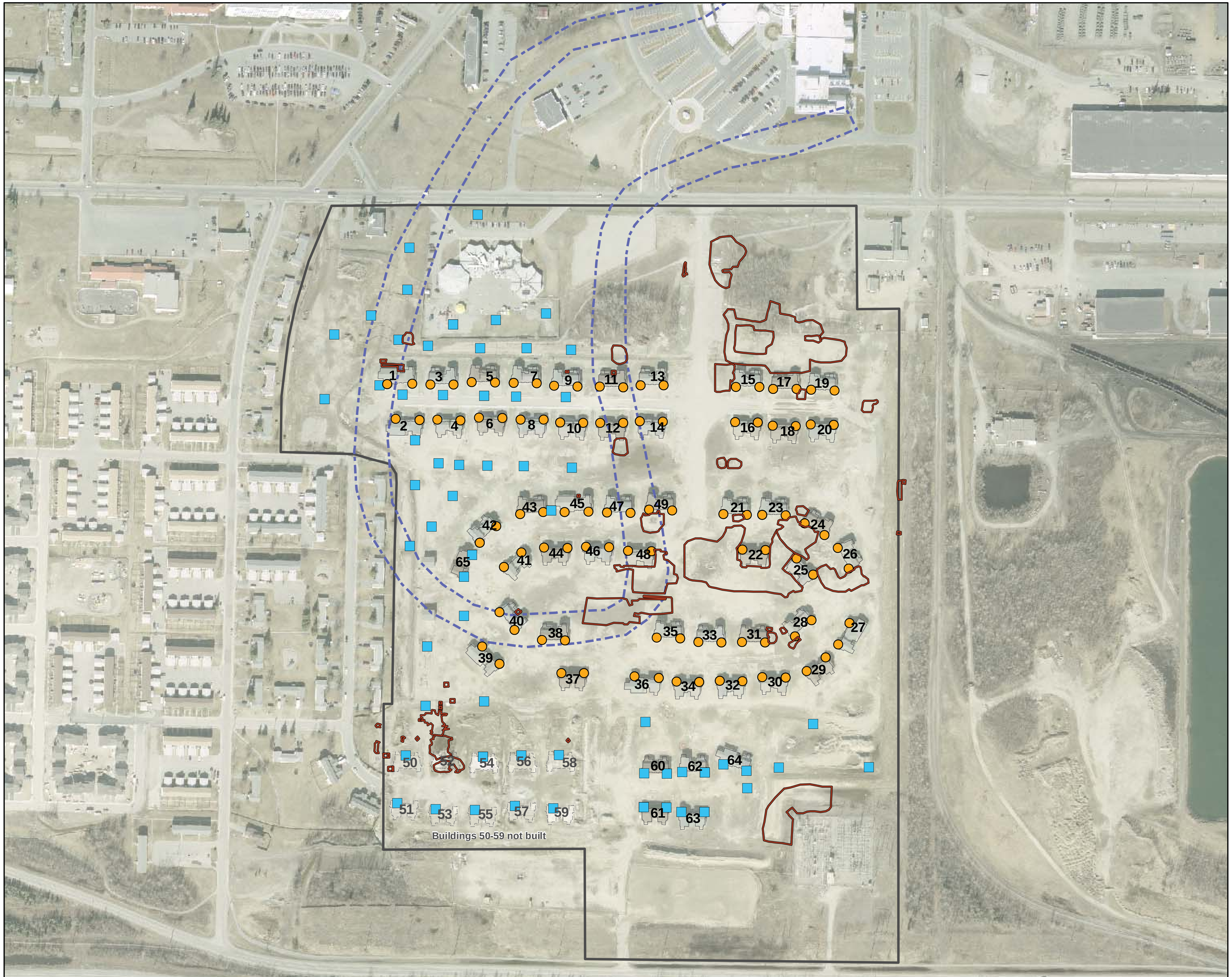
- Monitoring Well Location
- Water Supply Well Location
- Direct-push Grab Sample Location

0 275
Feet

FIGURE 3-7
Groundwater Samples Used in Nature and Extent and Risk Evaluations
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_SAMPLES.MXD RGRABARE 3/12/2010

CH2MHILL



LEGEND

Site Boundary

Former Hoppe's Slough

Excavation Boundary

Location Type

Vadose Zone Soil Gas Sample Location

Sub-slab Sample Location

0 275

Feet

N

FIGURE 3-8
Soil Gas Samples Used in Nature and Extent Evaluation
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

CH2MHILL

SECTION 4

Source Characterization

This section describes the nature of the debris, munitions-related items, and other possible sources of contamination at FCS and includes a qualitative assessment of historical contaminant sources in FCS, as determined through RI excavations and waste characterization activities. In addition to the qualitative assessment, this section contains summarized analytical results for samples of waste and contaminated soil that could have acted as primary or secondary sources of contaminants prior to its discovery, removal, and disposal as IDW during the RI.

Note that this description of possible sources is not to be confused with the nature and extent of contamination, which focuses on residual contamination left at FCS following the PCB excavations, drum and debris investigations, and hot spot delineation efforts described in this section.

4.1 Buried Debris and Associated Contaminated Soil

The following summarizes the buried debris and materials encountered in the subsurface at different locations around the FCS:

- **Buildings 15 and 17.** Drums (mostly crushed and empty, although a few contained residual amounts of a fuel-water mixture or tar), furnaces with potential ACM, transformers, lead-acid batteries, charcoal, paint cans, and DMM and other munitions-related items, plus 238 yd^3 of contaminated soil.
- **Buildings 22 and 24.** Crushed and empty drums (a few containing an oily mixture; solids in the drum contained a mixture of petroleum related VOCs and PAHs; lead and other metals were also present), furnaces with potential ACM, transformers, a crushed fuel tank, lead-acid batteries, paint cans, empty compressed-gas cylinders, fire extinguishers, hydraulic cylinders with hydraulic oil, metals debris, spent artillery shells, and DMM and other munitions-related items, plus 34 yd^3 of contaminated soil.
- **Building 48.** Drums (mostly crushed and empty, although a few contained tar/asphalt residue, one had liquid containing degraded gasoline, one had white residue, and one contained unspecified liquid), a fuel bladder, cables, transformers, lead-acid battery plates, scrap metal, empty compressed-gas cylinders, and DMM and other munitions-related items, plus 150 yd^3 of contaminated soil.
- **Building 49.** Forty-five drums (mostly crushed and empty, although a few contained tar/asphalt material or degraded fuel), paint cans, metal debris, rubber bladders, concrete, burnt wood, and 3 yd^3 of contaminated soil (no munitions-related items were found.)
- **Subarea D.** Four hundred fifteen crushed and empty drums, two drums with residual oil, 2 yd^3 of paint-contaminated soil, and three munitions-related items.

- **>75-mV Anomalies**
  - **Building 11.** Ten crushed drums with residual tar and 336 yd^3 of soil with a burned appearance
  - **Building 12.** Four crushed and empty drums, lead-acid battery plates, and 24 yd^3 of creosote-coated lumber and surrounding soil
  - **Building 16.** Scrap metal (mostly banding)
  - **Building 26.** One crushed and empty drum, airplane engine parts, and 465 yd^3 of burned soil with small pieces of metal debris
  - **Buildings 28 and 31.** Miscellaneous metal debris, 60 yd^3 of fuel-contaminated soil, and munitions-related items.
- **<75-mV Anomalies**. Only utilities and minor amounts of surface metal debris; no drums canisters or other possible source of contamination were identified.

The excavation boundaries for these investigations are shown on Figure 4-1. The sizes of the investigation excavations, and the volumes and types of materials recovered and disposed of are listed in Tables 4-1, 4-2, and 4-3. The volumes and types of contaminated soils removed and disposed of during these investigations are listed in Tables 4-4 through 4-7. Further details about the investigations are provided in Appendix D.

4.2 Contaminated Soil

The RI included efforts to investigate and delineate the extent of contaminated soil at the FCS, beginning with the PCB removal action in Subarea E and continuing through investigation of the DDT hot spot in the northeastern portion of FCS in 2010. The sizes of the removal actions and investigation excavations, as well as volumes of soil recovered and disposed of during the RI are listed in Tables 4-1 through 4-3. The excavation boundaries are shown on Figure 4-1.

4.2.1 PCB Removal Action and Hot Spot Excavations

A large-scale PCB removal action occurred in the Building 52 area in 2007. This removal action was followed by additional excavation of PCB-contaminated soil in the same area during 2008. Smaller PCB hot spot excavations also took place around Subarea E and in the TSA during 2007.

Building 52

The excavation at Building 52 area was separated into four sections based on field screening results. Field screening in the northern, southern, and eastern sections identified PCB contamination between 1 and 10 mg/kg, and the central area contained PCB contamination above 10 mg/kg. Excavation began to the north and continued in a southerly direction. The final depth of the main excavation varied between 3 and 14 feet bgs. The total area of the excavation in Subarea E in 2007 was 12,527 ft^2. Because of the size of the excavation, excavation and backfilling activities occurred concurrently. Backfilling activities occurred only in portions of the excavation where confirmation results indicated that the area was below the 1 mg/kg action level for PCBs. The excavated soil was disposed of, as follows:

- Soil identified as having PCB concentrations above 50 mg/kg was placed into intermodal bulk containers, packaged, and manifested for offsite disposal. The container contents were sampled, labeled according to U.S. Department of Transportation guidance, transported to the Alaska Railroad company in Fairbanks, offloaded in Anchorage, and shipped to Chemical Waste Management Northwest, in Arlington, Oregon for disposal; 63 regulated intermodal bulk containers containing 1,167.6 tons of soil was disposed of in this manner.
- Soil identified as containing a concentration of PCBs between 10 and 50 mg/kg was also transported offsite in the manner described above; however, the waste was disposed of at a separate area of the Chemical Waste Management Northwest facility; 42 nonregulated intermodal bulk containers containing 690.5 tons of soil were disposed of in this manner.
- Soil identified as containing a concentration of PCBs between 1 and 10 mg/kg was stockpiled onsite in 2007. Three separate stockpiles were created in the PCB EZ. PCB-contaminated soil was also stored in the large stockpile south of the FCS. A total of 1,800 yd^3 of soil was removed from the excavations and stockpiled. These stockpiles were disposed of at the Fort Wainwright Landfill.

Several items relating to power generation, historically associated with the Taku Gardens area, were removed during the excavation, including copper wire, ceramic sections of transformers, and power poles.

The excavation was backfilled using local sand and gravel, in accordance with USAED (2007h) guidance. The area of excavation was limited to the north and west by underground utilities. Two areas of PCB contamination that were not excavated during the 2007 field season were excavated in 2008, and the contaminated areas were removed.

Subarea E Hot Spots

In 2007, five additional areas of PCB contamination were identified outside of the main investigation area: two immediately north of the exclusion zone, one to the west of the main excavation, and two within the playground area. These areas were excavated in 2008. Several small (100 to 395 ft^2) excavations were dug to depths of 2 to 6 feet to remove the PCB-contaminated soil. Following confirmation sampling, the area was backfilled and compacted, and the soil was transported to the Fort Wainwright Landfill for disposal.

PCB Hot Spots outside Subarea E

Two PCB hot spots in the TSA were excavated in 2007. Note the northern TSA hot spot excavation was divided into two parts, a large excavation on the west side of the sound berm and a smaller excavation on the east side of the sound berm. The total area of excavation was 1,116 ft^2, with a maximum depth of 2 feet bgs. A total of 116 yd^3 of PCB-contaminated soil was removed from this area and disposed of at the Fort Wainwright Landfill. Following confirmation sampling, the area was backfilled and compacted.

4.2.2 Heating-Oil Spill Investigations

Small heating-oil spills discovered in front of approximately 40 houses during construction activities at FCS were reported in 2005. However, no survey data to identify the exact locations of these hot spots were produced; therefore, in 2008, inspection was conducted to identify stained soil and zones of elevated PID readings. Of the 40 areas where spills had potentially occurred, stained soil with elevated PID readings was encountered only at Buildings 9, 40, and 45. The stained soil was removed, confirmation samples were collected, and the excavations were backfilled. The soil was stockpiled for eventual thermal treatment at Organic Incineration Technologies in North Pole, Alaska.

4.2.3 Building 9 POL Investigation

On July 7, 2009, field personnel reported fuel odors during grading activities north of Buildings 9 and 11. This area coincided with the location of a pipe removed in 2008. The lateral extent of POL contamination was determined through test pitting, and it was determined that contamination had migrated approximately 40 feet northwest of the apparent source. After the lateral extent of contamination had been roughly determined, excavation activities began, on August 4, 2009. The excavation was guided by PID readings; soil with PID readings exceeding 20 ppm was excavated and transported directly to waste stockpiles for future disposal. Materials encountered in the excavation included a variety of abandoned pipes. The final excavation footprint covered an area of approximately 109 feet by 45 feet. The eastern half of the excavation extended to 6 feet bgs where PID readings were below 20 ppm, and the western half extended to 15 feet bgs where groundwater was encountered. Approximately 920 yd^3 of soil were removed from the excavation and stockpiled for eventual thermal treatment at Organic Incineration Technologies in North Pole, Alaska.

4.2.4 Building 11 DDT Hot Spot

An evaluation of historical sample results was undertaken as part of planning for 2008 RI activities. This evaluation identified one historical surface soil sample location near Building 11 with a DDT concentration that exceeded the screening criterion by more than 10 times. The Building 11 DDT hot spot was excavated in 2008, with a total of 15 yd^3 of DDT-contaminated soil being removed and stored in Super Sacks for transport and disposal at Chemical Waste Management Northwest in Arlington, Oregon.

4.2.5 Building 15/17 DDT Hot Spot

An evaluation of confirmation sample results from 2009 was undertaken as part of the nature and extent and risk assessment evaluations. This evaluation identified a surface soil sample from eastern portion of the Building 15/17 backfilled excavation near Building 19 with a DDT concentration greater than 10 times the screening criterion. The 2009 DDT hotspot was investigated further in April 2010, with a total of 51 yd^3 of DDT-contaminated soil being removed and placed in Super Sacks and transported the long-term stockpile cell on the south end of the FCS for later disposal.

4.3 Chemical Characterization of Source Materials

Although no specific effort was conducted during the RI to quantitatively characterize contaminant concentrations in potential source areas at the FCS, the soil and waste characterization samples collected during the PCB removal action and investigations identified in Sections 4.1 and 4.2 provide a rough approximation of the types of chemicals that might have been used, released, or disposed of in FCS in the past.

Table 4-8 is a summary of analytical data for chemicals detected in the ex situ soil and waste characterization samples. Sample listings and analytical results used in this evaluation are provided in Appendix I. As indicated in Section 3.2, location information is not available for many of these samples, so coordination of sample results with a particular location, soil pile, or excavation is not always possible.

The more frequently detected organic chemicals consist of PCBs, petroleum hydrocarbons (DRO, RRO, GRO) and associated VOCs and PAHs, pesticides, herbicides, and explosives:

- **PCBs.** Consistent with the focus of PCB removal actions described in Section 4.2.1, the ex situ soil and waste samples with the highest concentrations of PCBs (up to 120,000 mg/kg) were collected from soils near, or in stockpiles associated with, Building 52 and the PCB EZ in Subarea E.
- **POL.** Waste samples with the highest concentrations of petroleum (up to 120,000 mg/kg DRO) were taken from drums containing residual oily material or tar; whereas, soil samples with the highest concentrations of DRO (up to 22,300 mg/kg) and petroleum-related VOCs and PAHs were collected from now-excavated subsurface soils and soil piles in the vicinity of Buildings 7 and 9.
- **Pesticides and herbicides.** Pesticide and herbicide detections were scattered throughout soil piles and the now-excavated soils at FCS. With the exception of the two DDT hot spots described in Sections 4.2.4 and 4.2.5, the detected concentrations were below the project screening levels and landfill waste criteria and appear to be consistent with routine application of the chemicals for insect and weed control.
- **Explosives.** Soil pile and other waste characterization samples collected in Subarea A were analyzed for explosives due to the presence of munitions-related items. Low concentrations of explosives were detected in several of these samples, but concentrations of these chemicals were below project screening levels and landfill waste criteria.

4.4 Residual Buried Debris

As indicated in Sections 4.1 and 4.2, significant efforts have been made to investigate buried debris and associated contaminated soil at the FCS. All large and/or dense (greater than 75 mV) geophysical anomalies that were thought to be indicative of large volumes of buried debris and/or drums[1] and, thus, possible contaminant sources, have been investigated. In addition, a number of smaller anomalies were also investigated and cleared during the course of the RI. Clearance of the large and smaller anomalies is evidenced by comparing the 2007 and 2009 RI geophysical maps (see Figure 4-2)[2].

However, based on observations from nearby RI excavations, past uses, or subdivision construction notes, some residual debris likely remains near and possibly underneath

[1] It was not within the scope of the RI to investigate and remove every greater-than-75-mV geophysical anomaly identified at the FCS; professional judgment was used to guide the exploratory excavations to areas where large volumes of debris may have been buried based on proximity to historical operations or topographic features.

[2] The high density anomalies around and north of the SAS building are associated with fencing, reinforced concrete sidewalks, utilities for the building, and lighting for the parking lot. Because of the linear nature of these anomalies and observations of above ground evidence of utilities (e.g., vents and service vaults), the anomalies were not recommended for subsurface investigation.

several buildings. Such debris was not removed because of concerns about the structural stability of the buildings, the risks posed to workers and equipment during excavation activities, and because only limited chemical contamination had been found in conjunction with buried debris at the FCS, as evidenced by the expanded and highly engineered excavation to remove drums beneath the Building 49 foundation in 2009. Buildings where debris appears to continue beneath the foundation and has not been removed consist of Buildings 15, 17, 22, 24, and 48, as shown in orange on Figure 4-3. The overall findings and lines of evidence used to determine whether buried debris might underlie a building are presented in Table 4-9. As indicated above, the presence of buried metal does not always correlate with the presence of intact drums of chemicals or contaminated soil; it is only a suggestion that such conditions are possible.

TABLE 4-1
Summary of 2007 Excavation Activities

Excavation	Area of Excavation (ft^2)	Drums	Contaminated Soil (yd^3)	MD	DMM
Bldg. 49	4,500	186	24	0	0
Bldg. 48	32,000	159	150	20	0
Bldg. 15/17	9,400	75	3	257	5[a]
Bldgs. 22, 24	—	—	0	540	0
PCB Investigation	12,527	—	972.5[b] 575[c]	—	—
Totals	58,427	420	1,724.5	817	5[a]

[a]EOD detonated these items and reported them as high-explosive filled.

[b]Concentration of PCBs greater than or equal to 50 mg/kg (TSCA).
[c]Concentration of PCBs greater than or equal to 10 mg/kg and less than 50 mg/kg (Non-TSCA)

TABLE 4-2
Summary of 2008 Excavation Activities

Excavation	Area of Excavation (ft^2)	Drums	Contaminated Soil (yd^3)	MD	DMM
Bldg. 1	6,161	1	—	—	—
Bldg. 11	4,449	10	15	—	—
Bldg. 12	3,563	4	24	—	—
PCB area[a]	970	—	1,720[b]	—	—
Bldg. 15/17	75,579	115	238	538	1
Between Bldgs. 16 and 21	5,262	—	—	—	—
Bldgs. 22, 24	66,190	39	34	1,552	
Bldg. 26	5,587	1	7	—	—
Bldg. 28, 31	1,497	—	60	6	—
Area D	25,876	415	2	3	—
Bldg. 40	170	—	60	—	—
Bldg. 45	60	—	3	—	—
Bldg. 9	60	—	3	—	—
Bldg. 43	1,401	—	—	—	—
Bldg. 29	3,236	—	—	—	—
Bldg. 38	1,488	—	—	—	—
Totals	201,549	585	2,166	2,099	2

[a]Stockpiled in 2007, removed in 2008.

[b]Concentration of PCBs greater than or equal to 1 mg/kg and less than 10 mg/kg (non-TSCA).

TABLE 4-3
Summary of 2009 Excavation Activities

Excavation	Area of Excavation (ft^2)	Drums	Contaminated Soil (yd^3)	MD	DMM
Bldg. 9	4,905	—	920	0	0
Bldg. 11	10,575	8	—	0	0
Bldg. 35	432	—	—	0	0
Area E foundation demolition	30,000	—	—	0	0
Bldg. 15/17	22,050	—	—	0	0
Bldg. 49	2,500	45	3	0	0
Totals	70,462	53	923	**0**	**0**

TABLE 4-4
2007 Contaminated Soil Disposal Information

Excavation	Contaminant	Volume of Soil (yd^3)	Corresponding Sample IDs	Disposal Location
Bldg. 49	VOC	6	07FCSRISOB49P01	Thermal treatment OIT/Ft. Wainwright Landfill
	Asphalt	18	07FCSRISOB49T01	Thermal treatment OIT/Ft. Wainwright Landfill
Bldg. 48	Heavy metals	30	07FCSRISOBD48P B01-02	Thermal treatment OIT/Ft. Wainwright Landfill
	Degraded fuel (xylenes)	120	07FCSRISOSS0104	Thermal treatment OIT/Ft. Wainwright Landfill
Bldg. 15/17	Heavy metals	3	07 FCSRISO B15 PB01	Chemical Waste Management, Arlington, Ore.

Note: All 2008 waste soil was resampled according to USAED (2009h). Samples with POL in exceedances of project screening criteria were transported to OIT for thermal treatment. Remaining soil (nonhazardous) was disposed of at Ft. Wainwright Landfill.

TABLE 4-5
2008 Contaminated Soil Disposal Information

Excavation	Potential Contaminant	Volume of Soil (yd^3)	Sample IDs	Disposal Destination
Bldg. 15/17	POL	210	08 FCSRISO B15 WSLP01-6	Thermal treatment OIT/Ft. Wainwright Landfill
Bldg. 15	Paint Thinner	8	08 FCS BLD 15 PT 01-02	Thermal treatment OIT/Ft. Wainwright Landfill
Bldgs. 15, 22	Lead	20	08 FCS BLD 15 BAT 01-02	Chemical Waste Management, Arlington, Ore.
Bldg. 22	POL	30	08 FCS RISO B22 WS-01-02	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 22	Paint	4	08 FCS BLD22 PT 01-02	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 40	POL	56	08 FCS PCS HS 01-3	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 31	POL	60	08 FCS RISO B31 FL01-03	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 26	Heavy metals	7	08 FCS RISO B 26-WS01-2	Chemical Waste Management, Arlington, Ore.
Bldg. 9	POL	3	08 FCS PCS HS 01-3	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 45	POL	3	08 FCS PCS HS 01-3	Thermal Treatment OIT/Ft. Wainwright Landfill
Bldg. 11	Pesticides	15	08 FCS RISO BLD11WS01-02	Chemical Waste Management, Arlington, Ore.
Offsite stockpile	Unknown	11	08 FCS RISO OFFSITE 01-02	Ft. Wainwright Landfill

Note: All 2008 waste soil was resampled according to USAED (2009h). Samples with POL in exceedances project screening criteria were transported to OIT for thermal treatment. Remaining soil (nonhazardous) was disposed of at Ft. Wainwright Landfill.

TABLE 4-6
2009 Contaminated Soil Disposal Information

Excavation	Contaminant	Volume of Soil (yd^3)	Sample IDs	Disposal Location
Building 9	POL	920	09-FCSRI-SO-B9SP01WS01-07	OIT
			09-FCSRI-SO-B9SP02WS01-05	OIT
			09-FCSRI-SO-B9SP03WS01-15	OIT
Building 49	POL	3	09 FCS RISO B49WS01	OIT

TABLE 4-7
Liquid Waste Disposal Information (2007/2008/2009)

Area of Excavation	Liquid Waste Description	Approximate Volume (Cumulative Total)	Sample IDs	Disposal Destination
2007 Liquid Waste				
Building 49	Motor oil and water	5 gallons	07FCSRIWWB49OD-01	Placed in DOT approved overpack and transported to ECC
Building 48	Degraded fuel (xylenes)	20 gallons	07FCSRIWWB48DR14	Placed in DOT approved overpack and transported to ECC
	POL water	40 gallons	07FCSRIWWB4803	Placed in DOT approved overpack and transported to ECC
Building 15	1 small (ft length transformer)	Transformer	07FCSRI B15 TRAN 01	Consolidated with B48 Transformer for recycling at ECC
2008 Liquid Waste				
Building 15	Degraded fuel	10 gallons	08 FCS WW BLG15-05	Placed in DOT approved overpack and transported to ECC
Area D	Degraded fuel	5 gallons	08 FCS AREA D OP-04	Placed in DOT approved overpack and transported to ECC
2009 Liquid Wastes				
Building 49	Degraded fuel	1 gallon	09 FCS WW B49 DR01	Placed in DOT approved overpack and transported to ECC

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
GEN CHEM	FLASHPT	Flash Point	DEG C	6	6	100%	--	--	110	110	--	--	--
GEN CHEM	FLASHPT	Flash Point	DEG F	2	2	100%	--	--	84	212	--	--	--
VOC	630-20-6	1,1,1,2-Tetrachloroethane	mg/kg	3	177	2%	0.0024	25	0.007	0.0091	1.9	--	2
VOC	71-55-6	1,1,1-Trichloroethane	mg/kg	5	177	3%	0.00088	25	0.0032	0.065	36	--	--
VOC	79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	3	177	2%	0.00075	25	0.0055	0.0072	0.55	--	6
VOC	79-00-5	1,1,2-Trichloroethane	mg/kg	3	177	2%	0.0025	23	0.0059	0.0077	1.1	--	5
VOC	75-34-3	1,1-Dichloroethane	mg/kg	3	177	2%	0.00084	62	0.0069	0.009	90	--	--
VOC	75-35-4	1,1-Dichloroethene	mg/kg	3	177	2%	0.0013	34	0.0054	0.007	0.085	--	6
VOC	563-58-6	1,1-Dichloropropene	mg/kg	3	177	2%	0.00095	20	0.007	0.0091	--	--	--
VOC	87-61-6	1,2,3-Trichlorobenzene	mg/kg	6	177	3%	0.00083	31	0.0366	3,140	4.9	4	1
VOC	96-18-4	1,2,3-Trichloropropane	mg/kg	4	177	2%	0.00084	25	0.012	410	0.017	1	103
VOC	120-82-1	1,2,4-Trichlorobenzene	mg/kg	7	200	4%	0.00083	793	0.015	6,480	4.1	4	1
VOC	95-63-6	1,2,4-Trimethylbenzene	mg/kg	13	177	7%	0.00056	13	0.0027	6,400	4.9	2	1
VOC	96-12-8	1,2-Dibromo-3-chloropropane	mg/kg	3	177	2%	0.0074	517	0.1	0.13	0.0054	3	169
VOC	106-93-4	1,2-Dibromoethane	mg/kg	3	177	2%	0.00087	43	0.0051	0.0066	0.06	--	8
VOC	95-50-1	1,2-Dichlorobenzene	mg/kg	7	200	4%	0.00071	793	0.0049	43.4	4.5	3	1
VOC	107-06-2	1,2-Dichloroethane	mg/kg	3	177	2%	0.00081	53	0.0072	0.0093	0.48	--	6
VOC	78-87-5	1,2-Dichloropropane	mg/kg	3	177	2%	0.00066	16	0.0082	0.011	0.53	--	6
VOC	108-67-8	1,3,5-Trimethylbenzene	mg/kg	14	177	8%	0.0016	13	0.0048	1,700	4.2	2	1
VOC	541-73-1	1,3-Dichlorobenzene	mg/kg	3	200	2%	0.00083	793	0.0045	0.0059	6.9	--	2
VOC	142-28-9	1,3-Dichloropropane	mg/kg	3	177	2%	0.00063	27	0.0039	0.0051	160	--	--
VOC	106-46-7	1,4-Dichlorobenzene	mg/kg	3	200	2%	0.00086	793	0.0042	0.0055	3	--	2
VOC	594-20-7	2,2-Dichloropropane	mg/kg	3	177	2%	0.0012	31	0.0071	0.0092	--	--	--
VOC	78-93-3	2-Butanone	mg/kg	12	177	7%	0.006	130	0.0062	520	2,330	--	--
VOC	110-75-8	2-Chloroethyl vinyl ether	mg/kg	--	53	0%	0.0146	51.7	--	--	--	--	--
VOC	95-49-8	2-Chlorotoluene	mg/kg	4	177	2%	0.00068	38	0.0036	22	160	--	--
VOC	591-78-6	2-Hexanone	mg/kg	3	177	2%	0.0031	1,300	0.12	0.16	21	--	2
VOC	106-43-4	4-Chlorotoluene	mg/kg	4	177	2%	0.00095	23	0.0041	4.7	550	--	--
VOC	99-87-6	4-Isopropyltoluene	mg/kg	10	177	6%	0.0007	13	0.0045	680	--	--	--
VOC	108-10-1	4-Methyl-2-pentanone	mg/kg	5	177	3%	0.0055	130	0.0063	0.578	210	--	--
VOC	67-64-1	Acetone	mg/kg	24	175	14%	0.0076	190	0.057	0.88	6,860	--	--
VOC	71-43-2	Benzene	mg/kg	18	192	9%	0.00081	18	0.0012	0.015	1.1	--	2
VOC	108-86-1	Bromobenzene	mg/kg	3	177	2%	0.00057	23	0.0061	0.0079	30	--	--
VOC	74-97-5	Bromochloromethane	mg/kg	5	177	3%	0.001	31	0.007	0.096	--	--	--
VOC	75-27-4	Bromodichloromethane	mg/kg	3	177	2%	0.00058	18	0.0046	0.006	1	--	5
VOC	75-25-2	Bromoform	mg/kg	4	177	2%	0.0016	18	0.0096	0.013	42	--	--
VOC	74-83-9	Bromomethane	mg/kg	3	177	2%	0.00095	180	0.022	0.029	1.4	--	6
VOC	75-15-0	Carbon Disulfide	mg/kg	3	177	2%	0.002	51.7	0.0055	0.0072	25	--	2
VOC	56-23-5	Carbon tetrachloride	mg/kg	3	177	2%	0.00058	19	0.0075	0.0097	0.31	--	6
VOC	108-90-7	Chlorobenzene	mg/kg	4	177	2%	0.00087	78	0.0049	0.0091	20	--	1
VOC	75-00-3	Chloroethane	mg/kg	3	177	2%	0.0029	190	0.018	0.023	2.3	--	5
VOC	67-66-3	Chloroform	mg/kg	4	177	2%	0.00083	25	0.009	0.206	0.32	--	6
VOC	74-87-3	Chloromethane	mg/kg	5	177	3%	0.0017	47	0.0065	0.02	2.5	--	2
VOC	156-59-2	cis-1,2-Dichloroethene	mg/kg	3	177	2%	0.00098	39	0.0055	0.0072	13	--	1
VOC	10061-01-5	cis-1,3-Dichloropropene	mg/kg	3	177	2%	0.00071	18	0.0062	0.0081	--	--	--
VOC	124-48-1	Dibromochloromethane	mg/kg	3	177	2%	0.0027	16	0.0068	0.0088	1.4	--	5
VOC	74-95-3	Dibromomethane	mg/kg	3	177	2%	0.00064	47	0.013	0.017	37	--	1
VOC	75-71-8	Dichlorodifluoromethane	mg/kg	7	177	4%	0.00098	36	0.01	0.11	38	--	--
VOC	100-41-4	Ethylbenzene	mg/kg	18	192	9%	0.00095	13	0.0034	130	11	3	1
VOC	87-68-3	Hexachlorobutadiene	mg/kg	4	200	2%	0.00098	793	0.011	0.037	0.38	--	6
VOC	98-82-8	Isopropylbenzene	mg/kg	8	177	5%	0.00057	13	0.0045	210	6.2	2	1

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
VOC	108-38-3/1	m,p-Xylene	mg/kg	19	180	11%	0.00089	25	0.0093	930	340	1	--
VOC	75-09-2	Methylene chloride	mg/kg	17	177	10%	0.00093	51.7	0.0068	48	16	2	2
VOC	1634-04-4	Methyl-tert-butyl ether (MTBE)	mg/kg	5	162	3%	0.0019	20	0.015	0.19	29	--	--
VOC	104-51-8	n-Butylbenzene	mg/kg	7	177	4%	0.00073	16	0.0048	49	4.2	1	2
VOC	103-65-1	n-Propylbenzene	mg/kg	7	177	4%	0.00099	13	0.0042	460	4.2	2	1
VOC	95-47-6	o-Xylene	mg/kg	14	180	8%	0.0016	13	0.0051	560	380	1	--
VOC	135-98-8	sec-Butylbenzene	mg/kg	7	177	4%	0.00083	13	0.0048	510	4.1	2	1
VOC	100-42-5	Styrene	mg/kg	3	177	2%	0.00084	21	0.0045	0.0059	20	--	1
VOC	98-06-6	tert-Butylbenzene	mg/kg	6	177	3%	0.0006	22	0.0032	0.036	7	--	2
VOC	127-18-4	Tetrachloroethene (PCE)	mg/kg	5	177	3%	0.00067	47	0.0062	0.077	1	--	5
VOC	109-99-9	Tetrahydrofuran	mg/kg	--	3	0%	0.012	0.019	--	--	--	--	--
VOC	108-88-3	Toluene	mg/kg	35	192	18%	0.00067	25	0.0011	54.6	22	3	1
VOC	156-60-5	trans-1,2-Dichloroethene	mg/kg	3	177	2%	0.001	28	0.0074	0.0096	16	--	1
VOC	10061-02-6	trans-1,3-Dichloropropene	mg/kg	3	177	2%	0.00083	18	0.0087	0.012	--	--	--
VOC	79-01-6	Trichloroethene (TCE)	mg/kg	4	177	2%	0.00066	19	0.009	0.036	0.057	--	9
VOC	75-69-4	Trichlorofluoromethane	mg/kg	3	177	2%	0.00088	25	0.0075	0.0097	99	--	--
VOC	76-13-1	Trichlorotrifluoroethane (Freon 113)	mg/kg	--	3	0%	0.015	0.024	--	--	75	--	--
VOC	108-05-4	Vinyl Acetate	mg/kg	--	9	0%	0.022	0.055	--	--	150	--	--
VOC	75-01-4	Vinyl chloride	mg/kg	3	177	2%	0.0018	34	0.0096	0.013	0.43	--	6
VOC	1330-20-7	Xylenes, Total	mg/kg	14	46	30%	0.0034	0.0723	0.013	0.914	6.3	--	--
TPH	PHCD	DRO	mg/kg	147	179	82%	0.32	6.71	0.9	120,000	1,025	23	--
TPH	PHCG	GRO	mg/kg	23	110	21%	0.156	6.2	0.45	20,000	140	1	--
TPH	TPH-Oil	RRO	mg/kg	95	132	72%	3.74	190	6.6	13,500	1,000	2	--
SVOC	122-66-7	1,2-Diphenylhydrazine	mg/kg	--	10	0%	0.015	0.15	--	--	0.61	--	--
SVOC	95-95-4	2,4,5-Trichlorophenol	mg/kg	2	152	1%	0.00092	793	0.04	1.3	650	--	1
SVOC	88-06-2	2,4,6-Trichlorophenol	mg/kg	--	152	0%	0.0018	793	--	--	46	--	4
SVOC	120-83-2	2,4-Dichlorophenol	mg/kg	1	152	1%	0.0018	793	0.037	0.037	23	--	4
SVOC	105-67-9	2,4-Dimethylphenol	mg/kg	--	150	0%	0.0016	793	--	--	130	--	2
SVOC	51-28-5	2,4-Dinitrophenol	mg/kg	--	152	0%	0.036	6,300	--	--	16	--	6
SVOC	91-58-7	2-Chloronaphthalene	mg/kg	1	152	1%	0.0016	793	0.042	0.042	470	--	1
SVOC	95-57-8	2-Chlorophenol	mg/kg	1	152	1%	0.0016	793	0.038	0.038	51	--	4
SVOC	534-52-1	2-Methyl-4,6-dinitrophenol	mg/kg	--	152	0%	0.0017	6,300	--	--	0.61	--	120
SVOC	95-48-7	2-Methylphenol (o-Cresol)	mg/kg	--	152	0%	0.0016	793	--	--	320	--	1
SVOC	88-74-4	2-Nitroaniline	mg/kg	1	152	1%	0.0027	793	0.057	0.057	61	--	4
SVOC	88-75-5	2-Nitrophenol	mg/kg	2	152	1%	0.0022	793	0.042	45	--	--	--
SVOC	108-39-4/106	3&4-Methylphenol	mg/kg	--	137	0%	0.0033	955	--	--	35	--	4
SVOC	91-94-1	3,3'-Dichlorobenzidine	mg/kg	1	151	1%	0.0037	793	0.029	0.029	1.1	--	8
SVOC	99-09-2	3-Nitroaniline	mg/kg	--	152	0%	0.0026	793	--	--	--	--	--
SVOC	101-55-3	4-Bromophenyl phenyl ether	mg/kg	2	152	1%	0.0014	793	0.013	0.052	--	--	--
SVOC	59-50-7	4-Chloro-3-methylphenol	mg/kg	2	143	1%	0.00084	793	0.048	23	610	--	1
SVOC	106-47-8	4-Chloroaniline	mg/kg	--	152	0%	0.0021	793	--	--	9	--	4
SVOC	7005-72-3	4-Chlorophenyl phenyl ether	mg/kg	1	152	1%	0.002	793	0.048	0.048	--	--	--
SVOC	106-44-5	4-Methylphenol (p-Cresol)	mg/kg	--	15	0%	0.0029	0.067	--	--	--	--	--
SVOC	100-01-6	4-Nitroaniline	mg/kg	1	152	1%	0.0034	1,520	0.053	0.053	24	--	5
SVOC	100-02-7	4-Nitrophenol	mg/kg	1	152	1%	0.0012	3,150	0.43	0.43	--	--	--
SVOC	62-53-3	Aniline	mg/kg	--	48	0%	0.0768	793	--	--	85	--	4
SVOC	103-33-3	Azobenzene	mg/kg	--	110	0%	0.0024	793	--	--	5.1	--	4
SVOC	65-85-0	Benzoic acid	mg/kg	4	143	3%	0.061	3,150	0.31	0.54	31,700	--	--
SVOC	100-51-6	Benzyl alcohol	mg/kg	5	143	3%	0.0024	793	0.0039	0.12	610	--	1
SVOC	85-68-7	Benzyl butyl phthalate	mg/kg	7	152	5%	0.0015	793	0.0038	0.061	290	--	1
SVOC	111-91-1	bis-(2-Chloroethoxy)methane	mg/kg	1	152	1%	0.0013	793	0.037	0.037	18	--	4

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
SVOC	111-44-4	bis-(2-Chloroethyl)ether	mg/kg	1	152	1%	0.0024	793	0.033	0.033	0.33	--	17
SVOC	108-60-1	bis(2-Chloroisopropyl)ether	mg/kg	--	152	0%	0.0012	793	--	--	4.6	--	5
SVOC	117-81-7	bis-(2-Ethylhexyl)phthalate	mg/kg	14	151	9%	0.013	793	0.019	12	22	--	4
SVOC	86-74-8	Carbazole	mg/kg	2	95	2%	0.0013	4.2	0.0015	0.07	29	--	--
SVOC	132-64-9	Dibenzofuran	mg/kg	2	152	1%	0.0013	793	0.025	0.047	20	--	4
SVOC	84-66-2	Diethyl phthalate	mg/kg	2	152	1%	0.0035	793	0.044	0.053	6,190	--	--
SVOC	131-11-3	Dimethyl phthalate	mg/kg	7	152	5%	0.0018	793	0.0021	0.22	77,300	--	--
SVOC	84-74-2	Di-n-butyl phthalate	mg/kg	11	152	7%	0.006	793	0.0093	0.1	790	--	1
SVOC	117-84-0	Di-n-octyl phthalate	mg/kg	5	152	3%	0.0012	793	0.035	7.5	310	--	1
SVOC	118-74-1	Hexachlorobenzene	mg/kg	2	152	1%	0.0021	793	0.045	0.091	0.15	--	18
SVOC	77-47-4	Hexachlorocyclopentadiene	mg/kg	--	58	0%	0.026	3,150	--	--	0.2	--	49
SVOC	67-72-1	Hexachloroethane	mg/kg	1	152	1%	0.0022	793	0.0891	0.0891	6.5	--	4
SVOC	78-59-1	Isophorone	mg/kg	1	152	1%	0.0012	793	0.043	0.043	530	--	1
SVOC	62-75-9	n-Nitrosodimethylamine	mg/kg	--	142	0%	0.0061	793	--	--	0.016	--	116
SVOC	621-64-7	n-Nitrosodi-n-propylamine	mg/kg	1	152	1%	0.002	793	0.041	0.041	0.052	--	59
SVOC	86-30-6	n-Nitrosodiphenylamine	mg/kg	3	152	2%	0.0013	793	0.049	0.25	75	--	4
SVOC	87-86-5	Pentachlorophenol	mg/kg	10	152	7%	0.0019	3,150	0.02	4.5	3.9	1	6
SVOC	108-95-2	Phenol	mg/kg	1	152	1%	0.0017	793	0.043	0.043	2,320	--	--
PESTICIDES	72-54-8	4,4'-DDD	mg/kg	79	94	84%	0.000095	0.054	0.0003	5.9	3	2	--
PESTICIDES	72-55-9	4,4'-DDE	mg/kg	84	94	89%	0.000042	0.054	0.00013	2.07	2.1	--	--
PESTICIDES	50-29-3	4,4'-DDT	mg/kg	92	95	97%	0.000071	0.216	0.0021	97	2.1	4	--
PESTICIDES	309-00-2	Aldrin	mg/kg	11	93	12%	0.000031	0.0409	0.00027	0.0068	0.03	--	1
PESTICIDES	319-84-6	alpha-BHC	mg/kg	10	93	11%	0.000064	0.0409	0.00049	0.022	0.12	--	--
PESTICIDES	5103-71-9	alpha-Chlordane	mg/kg	13	95	14%	0.000046	0.0409	0.00023	0.013	--	--	--
PESTICIDES	319-85-7	beta-BHC	mg/kg	9	93	10%	0.000069	0.0439	0.00035	0.048	0.4	--	--
PESTICIDES	57-74-9	Chlordane	mg/kg	--	10	0%	0.00213	0.213	--	--	1.9	--	--
PESTICIDES	319-86-8	delta-BHC	mg/kg	8	94	9%	0.000061	0.0409	0.00055	0.0039	--	--	--
PESTICIDES	60-57-1	Dieldrin	mg/kg	19	93	20%	0.000041	0.054	0.00034	0.035	0.032	1	1
PESTICIDES	959-98-8	Endosulfan I	mg/kg	12	93	13%	0.000044	0.0409	0.00035	0.0087	37.00	--	--
PESTICIDES	33213-65-9	Endosulfan II	mg/kg	22	94	23%	0.000048	0.093	0.00036	0.072	37.00	--	--
PESTICIDES	1031-07-8	Endosulfan sulfate	mg/kg	27	96	28%	0.000052	0.054	0.00024	0.047	37.00	--	--
PESTICIDES	72-20-8	Endrin	mg/kg	17	92	18%	0.000094	0.054	0.00056	0.02	0.2	--	--
PESTICIDES	7421-93-4	Endrin aldehyde	mg/kg	13	94	14%	0.00008	0.054	0.00053	0.16	--	--	--
PESTICIDES	53494-70-5	Endrin ketone	mg/kg	17	94	18%	0.000047	0.131	0.00067	0.024	--	--	--
PESTICIDES	58-89-9	gamma-BHC (Lindane)	mg/kg	18	92	20%	0.000068	0.0409	0.00012	0.011	0.56	--	--
PESTICIDES	12789-03-6	gamma-Chlordane	mg/kg	21	94	22%	0.000048	0.0409	0.00014	0.0095	1.6	--	--
PESTICIDES	76-44-8	Heptachlor	mg/kg	10	93	11%	0.000069	0.054	0.0003	0.012	0.13	--	--
PESTICIDES	1024-57-3	Heptachlor epoxide	mg/kg	12	92	13%	0.000056	0.054	0.00012	0.005	0.063	--	--
PESTICIDES	465-73-6	Isodrin	mg/kg	--	3	0%	0.00049	0.0016	--	--	--	--	--
PESTICIDES	72-43-5	Methoxychlor	mg/kg	21	96	22%	0.000091	0.216	0.00059	0.069	32	--	--
PESTICIDES	8001-35-2	Toxaphene	mg/kg	4	86	5%	0.0048	1.31	0.092	0.26	0.75	--	4
PCBs	12674-11-2	PCB-1016 (Aroclor 1016)	mg/kg	--	1022	0%	0.00131	2,170	--	--	1	--	12
PCBs	11104-28-2	PCB-1221 (Aroclor 1221)	mg/kg	--	1022	0%	0.00153	2,170	--	--	1	--	14
PCBs	11141-16-5	PCB-1232 (Aroclor 1232)	mg/kg	--	1022	0%	0.00153	2,170	--	--	1	--	12
PCBs	53469-21-9	PCB-1242 (Aroclor 1242)	mg/kg	--	1022	0%	0.000902	2,170	--	--	1	--	12
PCBs	12672-29-6	PCB-1248 (Aroclor 1248)	mg/kg	--	1022	0%	0.00153	2,170	--	--	1	--	12
PCBs	11097-69-1	PCB-1254 (Aroclor 1254)	mg/kg	7	1022	1%	0.000879	2,170	0.01	0.524	1	--	12
PCBs	11096-82-5	PCB-1260 (Aroclor 1260)	mg/kg	215	1023	21%	0.00127	0.279	0.0023	120,000	1	78	--
PCBs	37324-23-5	PCB-1262 (Aroclor 1262)	mg/kg	3	268	1%	0.00153	63	0.0032	0.0064	--	--	--
PCBs	11100-14-4	PCB-1268 (Aroclor 1268)	mg/kg	--	268	0%	0.00137	63	--	--	--	--	--

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
PAH	90-12-0	1-Methylnaphthalene	mg/kg	1	1	100%	--	--	26	26	28	--	--
PAH	91-57-6	2-Methylnaphthalene	mg/kg	4	152	3%	0.0012	793	0.24	320	28	2	4
PAH	83-32-9	Acenaphthene	mg/kg	4	152	3%	0.001	793	0.025	1.21	280	--	1
PAH	208-96-8	Acenaphthylene	mg/kg	1	152	1%	0.0014	793	0.042	0.042	280	--	1
PAH	120-12-7	Anthracene	mg/kg	5	152	3%	0.0014	793	0.0018	0.57	2,060	--	--
PAH	56-55-3	Benzo(a)anthracene	mg/kg	12	152	8%	0.0012	793	0.0015	0.35	0.49	--	17
PAH	50-32-8	Benzo(a)pyrene	mg/kg	11	152	7%	0.0016	793	0.0094	2.8	0.049	2	59
PAH	205-99-2	Benzo(b)fluoranthene	mg/kg	11	151	7%	0.0022	793	0.01	0.31	0.49	--	16
PAH	BZBFBZKF	Benzo(b)fluoranthene and Benzo(k)fluoranthene	mg/kg	--	1	0%	1.3	1.3	--	--	0.49	--	1
PAH	191-24-2	Benzo(g,h,i)perylene	mg/kg	15	152	10%	0.0012	793	0.0085	3.9	140	--	2
PAH	207-08-9	Benzo(k)fluoranthene	mg/kg	7	151	5%	0.0025	793	0.0033	0.35	4.9	--	4
PAH	218-01-9	Chrysene	mg/kg	9	152	6%	0.0014	793	0.0017	0.36	49	--	4
PAH	53-70-3	Dibenzo(a,h)anthracene	mg/kg	4	152	3%	0.0012	793	0.033	3.5	0.049	3	60
PAH	206-44-0	Fluoranthene	mg/kg	14	151	9%	0.0021	793	0.0025	0.5	190	--	1
PAH	86-73-7	Fluorene	mg/kg	7	152	5%	0.0017	793	0.032	4.1	230	--	1
PAH	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	10	152	7%	0.00079	793	0.0095	2.9	0.49	2	16
PAH	91-20-3	Naphthalene	mg/kg	5	202	2%	0.0007	793	0.036	2,600	2.8	2	4
PAH	85-01-8	Phenanthrene	mg/kg	27	151	18%	0.0012	793	0.0014	1.4	2,060	--	--
PAH	129-00-0	Pyrene	mg/kg	20	151	13%	0.0013	793	0.0015	1.1	140	--	2
METALS	7429-90-5	Aluminum	mg/kg	94	94	100%	--	--	4,780	533,000	7,700	46	--
METALS	7440-36-0	Antimony	mg/kg	75	94	80%	0.21	3.9	0.034	118	4.1	1	--
METALS	7440-38-2	Arsenic	mg/kg	130	131	99%	3	3	2.6	32.7	8.46	47	--
METALS	7440-39-3	Barium	mg/kg	130	131	99%	2	2	50.5	5,000	2,030	1	--
METALS	7440-41-7	Beryllium	mg/kg	95	95	100%	--	--	0.064	8.6	20	--	--
METALS	7440-69-9	Bismuth	mg/kg	18	63	29%	0.1	0.12	0.0881	213	--	--	--
METALS	7440-42-8	Boron	mg/kg	30	93	32%	0.65	29.6	0.65	48.6	1,600	--	--
METALS	7440-43-9	Cadmium	mg/kg	120	131	92%	0.05	0.0667	0.065	23.4	7.9	2	--
METALS	7440-70-2	Calcium	mg/kg	93	94	99%	296	296	2,340	8,870	--	--	--
METALS	7440-47-3	Chromium	mg/kg	131	131	100%	--	--	9.8	1,470	30	10	--
METALS	7440-48-4	Cobalt	mg/kg	94	95	99%	2	2	3.2	20.1	2.3	93	--
METALS	7440-50-8	Copper	mg/kg	95	95	100%	--	--	9.7	10,100	410	4	--
METALS	7439-89-6	Iron	mg/kg	95	95	100%	--	--	1,550	226,000	5,500	93	--
METALS	7439-92-1	Lead	mg/kg	133	133	100%	--	--	2.9	206,000	40	13	--
METALS	7439-95-4	Magnesium	mg/kg	94	94	100%	--	--	2,880	11,100	--	--	--
METALS	7439-96-5	Manganese	mg/kg	95	95	100%	--	--	82	671	180	91	--
METALS	7439-97-6	Mercury	mg/kg	111	130	85%	0.0001	0.013	0.0088	1.01	1.8	--	--
METALS	7439-98-7	Molybdenum	mg/kg	63	64	98%	2	2	0.25	14	39	--	--
METALS	7440-02-0	Nickel	mg/kg	95	95	100%	--	--	8.6	169	200	--	--
METALS	7440-09-7	Potassium	mg/kg	93	94	99%	78.9	78.9	438	1,890	--	--	--
METALS	7782-49-2	Selenium	mg/kg	111	131	85%	0.13	0.4	0.16	2.9	51	--	--
METALS	7440-22-4	Silver	mg/kg	108	130	83%	0.008	0.147	0.03	1.9	51	--	--
METALS	7440-23-5	Sodium	mg/kg	93	94	99%	493	493	207	757	--	--	--
METALS	7440-24-6	Strontium	mg/kg	62	63	98%	3.9	3.9	15.4	100	4,700	--	--
METALS	7440-28-0	Thallium	mg/kg	53	95	56%	0.025	0.99	0.035	0.37	0.81	--	1
METALS	7440-62-2	Vanadium	mg/kg	95	95	100%	--	--	10	44.7	71	--	--
METALS	7440-66-6	Zinc	mg/kg	95	95	100%	--	--	22.2	51,000	3,040	3	--
HERBICIDES	93-76-5	2,4,5-T	mg/kg	--	31	0%	0.00059	0.021	--	--	61	--	--
HERBICIDES	93-72-1	2,4,5-TP (Silvex)	mg/kg	2	31	6%	0.0021	0.029	0.046	0.9	52	--	--
HERBICIDES	94-75-7	2,4-D	mg/kg	3	31	10%	0.00082	0.02	0.0044	0.018	86	--	--
HERBICIDES	94-82-6	2,4-DB	mg/kg	3	31	10%	0.0017	0.05	0.03	0.058	49	--	--
HERBICIDES	75-99-0	Dalapon	mg/kg	2	31	6%	0.0048	0.16	0.18	0.31	180	--	--

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
HERBICIDES	1918-00-9	Dicamba	mg/kg	--	31	0%	0.00096	0.022	--	--	180	--	--
HERBICIDES	120-36-5	Dichlorprop	mg/kg	--	31	0%	0.0015	0.046	--	--	--	--	--
HERBICIDES	88-85-7	Dinoseb	mg/kg	--	31	0%	0.0024	0.033	--	--	6.1	--	--
HERBICIDES	94-74-6	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	2	31	6%	0.00091	13	0.8	8.3	3.1	1	3
HERBICIDES	93-65-2	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	23	0%	0.0011	13	--	--	6.1	--	1
GEN CHEM	24959-67-9	Bromide	mg/kg	1	13	8%	0.26	0.31	2.7	2.7	--	--	--
GEN CHEM	16887-00-6	Chloride	mg/kg	14	14	100%	--	--	1	26,400	--	--	--
GEN CHEM	57-12-5	Cyancide	mg/kg	2	6	33%	0.05	0.06	0.07	0.11	200	--	--
GEN CHEM	16984-48-8	Fluoride	mg/kg	10	13	77%	0.3	0.5	1.1	2.6	310	--	--
GEN CHEM	NO3N	Nitrogen, Nitrate (as N)	mg/kg	6	7	86%	0.049	0.049	1.2	43.3	--	--	--
GEN CHEM	NO3NO2N	Nitrogen, Nitrate-Nitrite	mg/kg	5	5	100%	--	--	0.35	10.3	--	--	--
GEN CHEM	NO2N	Nitrogen, Nitrite	mg/kg	--	7	0%	0.037	0.069	--	--	--	--	--
GEN CHEM	TPHOS	Phosphorus, Total (as P)	mg/kg	61	62	98%	197	197	273	697	--	--	--
GEN CHEM	14265-44-2	Phosphorus, Total Orthophosphate (as P)	mg/kg	--	13	0%	0.29	0.54	--	--	--	--	--
GEN CHEM	RECN	Reactive Cyanide	mg/kg	--	1	0%	28	28	--	--	--	--	--
GEN CHEM	SULFID-R	Reactive Sulfide	mg/kg	--	7	0%	28	45	--	--	--	--	--
GEN CHEM	14808-79-8	Sulfate	mg/kg	14	14	100%	--	--	2.7	223	--	--	--
EXPLOSIVES	99-35-4	1,3,5-Trinitrobenzene	mg/kg	18	54	33%	0.02	1	0.021	0.068	280	--	--
EXPLOSIVES	99-65-0	1,3-Dinitrobenzene	mg/kg	--	55	0%	0.05	2.5	--	--	0.71	--	1
EXPLOSIVES	118-96-7	2,4,6-Trinitrotoluene	mg/kg	--	55	0%	0.02	1	--	--	4.4	--	--
EXPLOSIVES	121-14-2	2,4-Dinitrotoluene	mg/kg	1	158	1%	0.0028	793	0.04	0.04	0.88	--	8
EXPLOSIVES	606-20-2	2,6-Dinitrotoluene	mg/kg	4	159	3%	0.0028	793	0.017	0.092	0.89	--	8
EXPLOSIVES	35572-78-2	2-Amino-4,6-dinitrotoluene	mg/kg	--	55	0%	0.1	5	--	--	2	--	1
EXPLOSIVES	88-72-2	2-Nitrotoluene	mg/kg	--	55	0%	0.08	4	--	--	2.6	--	1
EXPLOSIVES	99-08-1	3-Nitrotoluene	mg/kg	2	55	4%	0.07	3.5	0.077	0.095	150	--	--
EXPLOSIVES	19406-51-0	4-Amino-2,6-dinitrotoluene	mg/kg	--	55	0%	0.02	1	--	--	1.9	--	--
EXPLOSIVES	99-99-0	4-Nitrotoluene	mg/kg	1	55	2%	0.08	4	0.083	0.083	35	--	--
EXPLOSIVES	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	1	55	2%	0.04	2	0.058	0.058	7.2	--	--
EXPLOSIVES	479-45-8	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	55	0%	0.05	2.5	--	--	40	--	--
EXPLOSIVES	98-95-3	Nitrobenzene	mg/kg	1	158	1%	0.002	793	0.061	0.061	5.1	--	4
EXPLOSIVES	55-63-0	Nitroglycerin	mg/kg	1	55	2%	0.13	6.5	0.26	0.26	30	--	--
EXPLOSIVES	2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	55	0%	0.03	1.5	--	--	460	--	--
EXPLOSIVES	78-11-5	Pentaerythritol tetranitrate	mg/kg	7	55	13%	0.16	8	0.17	0.45	--	--	--
GEN CHEM	MOIST	Percent Moisture	percent	63	64	98%	0.1	0.1	2.2	49.3	--	--	--
GEN CHEM	SOLID	Solids, Percent	percent	203	203	100%	--	--	43	99.5	--	--	--
GEN CHEM	TSO	Total Solids	percent	815	815	100%	--	--	38.2	100	--	--	--
DIOXIN/FURAN	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/g	1	2	50%	0.46	0.46	0.271	0.271	--	--	--
DIOXIN/FURAN	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/g	2	2	100%	--	--	1.04	1.59	--	--	--
DIOXIN/FURAN	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	pg/g	2	2	100%	--	--	0.383	0.531	--	--	--
DIOXIN/FURAN	1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin	mg/kg	--	2	0%	2.11E-04	4.79E-04	--	--	4.50E-06	--	2

TABLE 4-8
Summary of Analytical Results for Source Characterization Samples - Solids
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte Name	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	Number of Detects > PSL	Number of Nondetects > PSL
DIOXIN/FURAN	39001-02-0	Octachlorodibenzofuran	pg/g	1	2	50%	0.92	0.92	1.12	1.12	--	--	--
DIOXIN/FURAN	3268-87-9	Octachlorodibenzo-p-dioxin	pg/g	2	2	100%	--	--	2.26	23.3	--	--	--
DIOXIN/FURAN	HPCDF	Total Heptachlorodibenzofurans (HpCDF)	pg/g	1	2	50%	0.46	0.46	0.35	0.35	--	--	--
DIOXIN/FURAN	HPCDD	Total Heptachlorodibenzo-p-dioxins (HpCDD)	pg/g	2	2	100%	--	--	1.59	1.76	--	--	--
DIOXIN/FURAN	HXCDF	Total Hexachlorodibenzofurans (HxCDF)	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	HXCDD	Total Hexachlorodibenzo-p-dioxins (HxCDD)	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	PECDF	Total Pentachlorodibenzofurans (PeCDF)	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	PECDD	Total Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	2	0%	0.46	0.565	--	--	--	--	--
DIOXIN/FURAN	TCDF	Total Tetrachlorodibenzofurans (TCDF)	pg/g	2	2	100%	--	--	0.748	0.865	--	--	--
DIOXIN/FURAN	TCDD	Total Tetrachlorodibenzo-p-dioxins (TCDD)	pg/g	--	2	0%	0.211	0.479	--	--	--	--	--
GEN CHEM	PH	pH	ph units	25	25	100%	--	--	6.23	8.6	--	--	--

Notes: 1746-01-6

mg/kg = milligrams per kilogram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semivolatile organic compounds
PCB = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

TABLE 4-9
Buildings with Possible Residual Buried Debris Concerns
Remedial Investigation Report Former Communications Site, Fort Wainwright, Alaska

Building	Debris Characterization
Buildings with Observed Debris Beneath Foundation	
Building 15	2004 magnetometer study indicated possible buried metal in vicinity of future building foundation. 2006 test pit near building found crushed fuel drum, debris, and POL contaminated soil. 2007/2008 Building 15/17 excavation investigation found drums (mostly crushed and empty, although a few contained residual amounts of a fuel-water mixture or tar), oil-burning furnaces with potential asbestos-containing material, transformers, lead-acid batteries, charcoal, and paint cans, as well as MEC, primarily MD but possibly some DMM such as M41 fragmentation bombs, M106 8-inch projectiles, and 3.5-inch M29 practice rockets. Debris observed along excavation sidewalls adjacent to building (removal terminated due to structural stability concerns).
Building 17	2004 magnetometer study indicated possible buried metal in vicinity of future building foundation. 2006 test pit near building found crushed drums. 2007/2008 Building 15/17 excavation found drums (mostly crushed and empty, although a few contained residual amounts of a fuel-water mixture or tar), furnaces with potential asbestos-containing material, transformers, lead-acid batteries, charcoal, and paint cans, as well as MEC, primarily MD but possibly some DMM such as M41 fragmentation bombs, M106 8-inch projectiles, and 3.5-inch M29 practice rockets, Debris observed along excavation sidewalls adjacent to building (removal terminated due to structural stability concerns).
Building 22	2004 magnetometer study indicated possible buried metal in vicinity of future building foundation. 2006 test pits south and west of building found drums and corroded metal, PCBs, and spent artillery shells. 2007/2008 Building 22/24 excavation found mostly crushed and empty drums, with a few containing an oily mixture, furnaces with potential asbestos-containing material, transformers, lead-acid batteries, paint cans, gas cylinders, fire extinguishers, hydraulic cylinders with hydraulic oil. In addition, DMM (M47 100-pound chemical bombs, M106 8-inch projectiles, and T-85 3.5-inch rocket motors with propellant) and MD were also found. Debris observed along excavation sidewalls adjacent to building (removal terminated due to structural stability concerns).
Building 24	2004 magnetometer study indicated possible buried metal in vicinity of future building foundation. 2006 test pits near building found spent artillery shells, metal debris, a crushed fuel tank, and POL odors. 2007/2008 Building 22/24 excavation found mostly crushed and empty drums, with a few containing an oily mixture, furnaces with potential asbestos-containing material, transformers, lead-acid batteries, paint cans, gas cylinders, fire extinguishers, hydraulic cylinders with hydraulic oil. In addition, DMM (M47 100-pound chemical bombs, M106 8-inch projectiles, and T-85 3.5-inch rocket motors with propellant) and MD were also found. Debris observed along excavation sidewalls adjacent to building (removal terminated due to structural stability concerns).
Building 48	2004 magnetometer study indicated possible buried metal in vicinity of future building foundation. 2006 test pits near building found crushed drums (mostly empty but one with white residue, and one with liquid) fuel bladder, gas cylinder, and cables. 2007 Building 48 excavation found drums (mostly crushed and empty, although a few contained tar/asphalt residue or liquids that were characterized as xylenes-based solvents), transformers, lead-acid battery plates, scrap metal, and gas cylinders. In addition, DMM (MK2 practice hand grenades) and MD were also found. Debris observed along excavation sidewalls adjacent to building (removal terminated due to structural stability concerns).

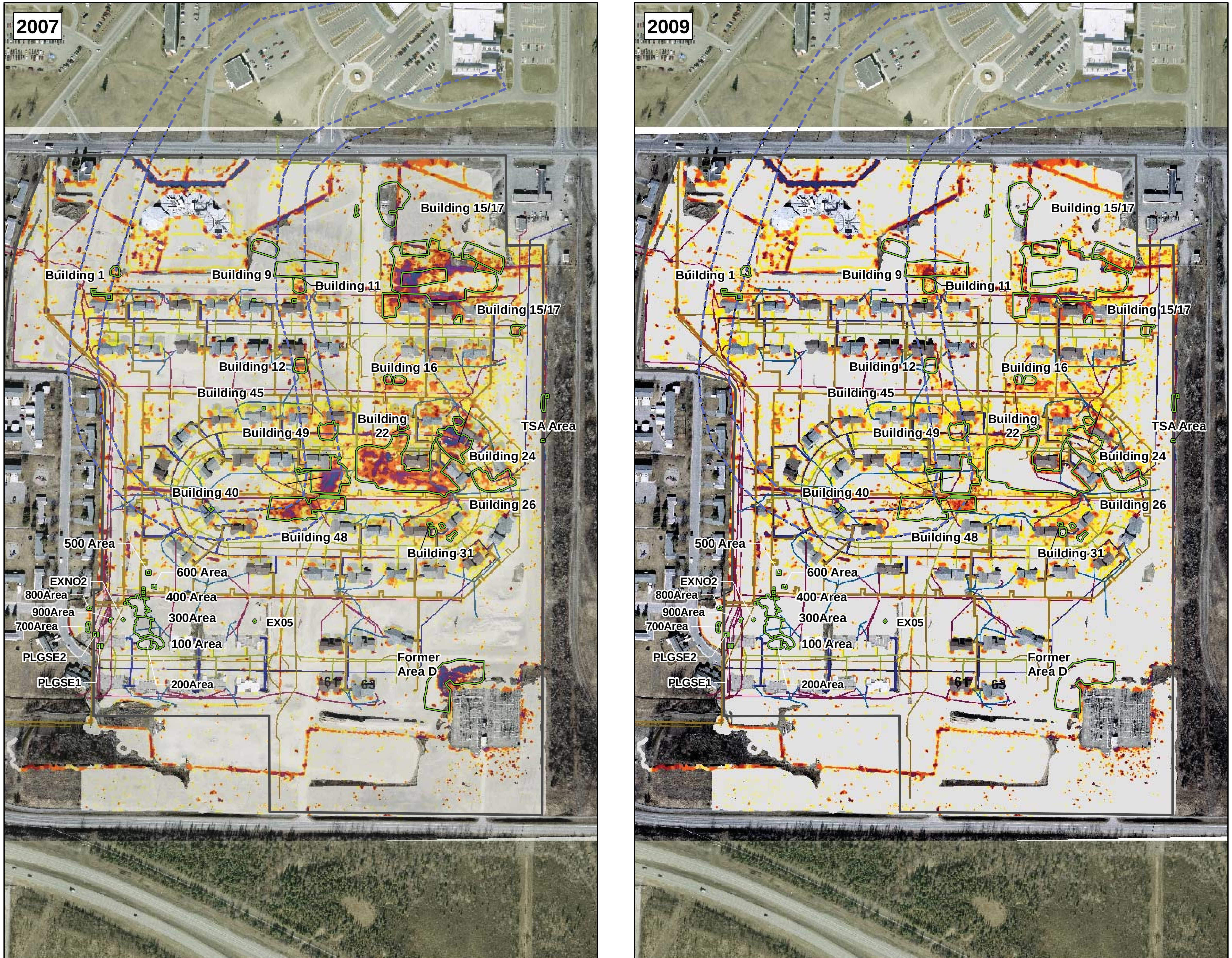
TABLE 4-9
Buildings with Possible Residual Buried Debris Concerns
Remedial Investigation Report Former Communications Site, Fort Wainwright, Alaska

Building	Debris Characterization
Buildings with Possible Debris Beneath Foundation	
Building 1	2004 magnetometer study indicated possible buried metal in vicinity of building foundation. 2006 test pits near building found construction debris (concrete, rebar, wood, aluminum sheeting) in the area. 2008 75-mV anomaly investigation north of Building 1 found an empty drum and a small quantity of scrap metal and construction debris. Building constructed over former Hoppe's Slough fill
Building 11	2004 magnetometer study indicated possible buried metal in vicinity of foundation. 2006 tests pits near building found POL in soil (70 cy), and crushed drums, and a 6x6 cylinder. 2008 75-mV anomaly excavations north of Building 11 found empty drums with residual tar, scrap metal debris, and burned soil.
Building 12	2004 magnetometer study indicated possible buried metal in vicinity of building foundation. 2006 test pits near building found decaying wood debris, burned wood, and a sour milk odor in the area. 2008 75 mV anomaly investigation south of Building 12 found empty drums, scrap metal debris, lead battery plates, and creosote-soaked timbers. Building constructed over former Hoppe's Slough fill.
Building 13	2004 magnetometer study indicated possible buried metal in vicinity of building foundation. Observations during foundation construction noted burnt wood and ash in soil, crushed drums, concrete/steel piping debris, and elevated PID readings. 2006 test pits near building found crushed drums and ash in soil. Building constructed near former Hoppe's Slough fill
Building 21	2004 magnetometer study indicated possible buried metal in vicinity of building foundation. Observations during foundation construction noted burnt wood, scrap metal debris, MD, JATO bottles. 2006 test pits near building found spent artillery shells and drums. 2008 Building 22/24 excavation extended to south side of foundation; debris observed along excavation sidewalls adjacent to building.
Building 25	2008 Building 22/24 excavation extended around southwest, west, and northwest sides of foundation; debris observed along excavation sidewalls adjacent to building.

LEGEND

Site Boundary
Former Hoppe's Slough
Excavation Boundary

FIGURE 4-1
Removal Action and Investigation Excavation Boundaries
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



LEGEND

- Site Boundary
- Former Hoppe's Slough
- Excavation Boundary

EM61 Response mV

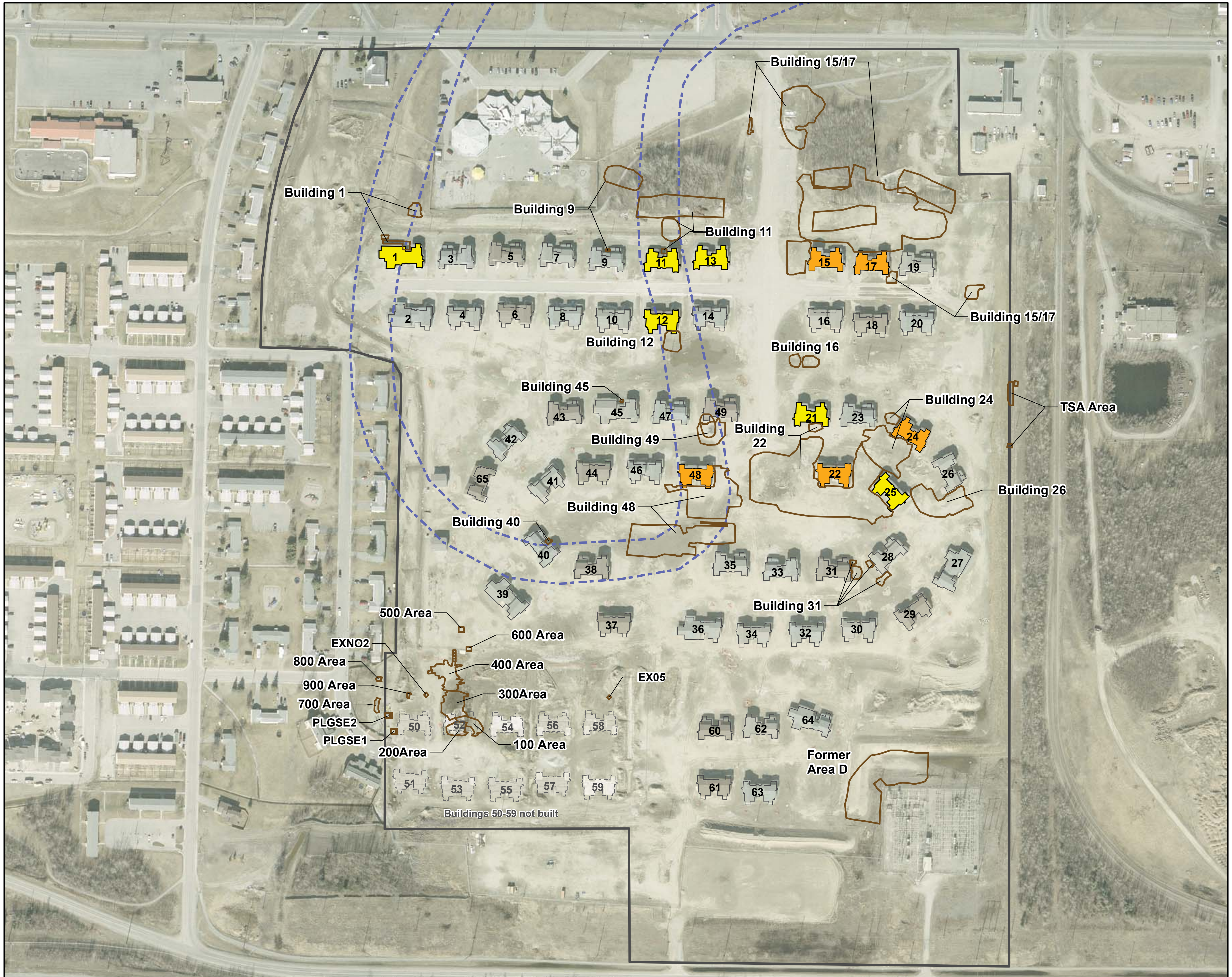
- 0
- 30
- 50
- 75
- 100
- 200
- 300
- 500
- 1000
- 2000

0 275
Feet

FIGURE 4-2
Comparison of 2007 and 2009 Geophysical Anomaly Maps
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_GEOCOMPARISON.MXD RGRABARE 3/24/10

CH2MHILL



LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area
- Building with Observed Debris Beneath Foundation
- Building with Possible Debris Beneath Foundation

0 275
Feet

N

FIGURE 4-3
Buildings with Possible Debris Beneath Foundation
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

SECTION 5

Nature and Extent of Contamination

As described in Section 4, significant efforts were made during the RI to identify and clear possible sources of contamination at the FCS. This section presents the findings of the nature and extent evaluations for chemical contaminants remaining in soil and groundwater at the FCS, describes the fate and transport considerations for the residual contaminants, and presents the updated CSM based on these findings and considerations.

The approach for evaluating the residual nature and extent of contamination included the following:

1. Comparing analytical data of appropriate quality for samples collected across FCS to conservative PSLs to determine which chemicals exceeded PSLs (i.e., COIs)

2. Mapping the distribution of COIs in FCS media and evaluating the patterns of PSL exceedances in each medium relative to possible sources identified in Section 3 and to the locations of PSL exceedances in other media

The PSLs used for the nature and extent evaluations were based primarily on the 2009 ADEC Method 2 Cleanup Levels, as listed in 18 AAC 75 Tables B1/B2 for soil and Table C for groundwater and adjusted to account for possible cumulative exposure from multiple chemicals.[1] For soil, the PSL consists of the lowest of the adjusted Under 40-inch Zone Direct Contact value and the adjusted Under 40-inch Zone Outdoor Inhalation value (or background if it is higher than the lowest Method 2–based value). For groundwater, the PSL consists of the adjusted Table C value for drinking water, or background if higher. The residential and tap water RSLs listed in the *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites* (EPA, 2009a), were used for analytes without ADEC values.[2]

Data used to evaluate the nature and extent of contamination in soil and groundwater include the following:

- **Surface Soil**: The samples used in the nature and extent evaluation for surface soil were collected in the upper 2 feet of soil and included samples collected specifically for surface soil characterization as well as samples from the upper 2 feet of the soil column on excavation sidewalls and within boreholes. Samples not considered representative of current in situ soil conditions (for example, samples collected prior to development of the Taku Gardens family housing development or samples collected prior to excavation of contaminated soil) were omitted from the data set, as were the MI samples collected from the soil piles in 2007 (the soil-pile sample results are included in the source characterization group). The results for MI samples collected from the sound berm in 2007 are evaluated separately from discrete surface soil samples. MI sample locations are

[1] The ADEC Method 2 cleanup levels are based on an excess lifetime cancer risk (ELCR) of 1×10^{-5} and a hazard index (HI) of 1, consequently the ADEC values for direct contact and outdoor inhalation listed in Tables B1/B2 and for groundwater ingestion in Table C were divided by 10 prior to selection of the lowest applicable value.

[2] The residential RSLs for noncarcinogenic chemicals are based on a HI of 1. Therefore, to account for possible cumulative risk associated with multiple chemical exposures, the listed RSLs for noncarcinogens were divided by 10.

shown in Figure 3-4 and discrete surface soil sample locations are shown in Figure 3-5. Full listings of the analytical results for surface soil samples are provided in Appendix I. (Headings in the Appendix I tables indicate the evaluation group assignment for each sample.)

- **Subsurface Soil**: The samples used in the nature and extent evaluation for subsurface soil were collected at depths greater than 2 feet bgs. These samples include those collected from boreholes advanced for monitoring well installation and from the floors and sidewalls of excavations. Samples not considered representative of current in situ soil conditions (for example, samples collected before excavation of contaminated soil) were omitted from the data set. However, samples located within excavations, but from intervals beneath the maximum depth of excavation, were included in the data set. Sample locations are shown in Figure 3-6. Full listings of the analytical results for the evaluation group are provided in Appendix I. (Headings in the Appendix I tables indicate the evaluation group assignment for each sample.)
- **Groundwater**: The samples used in the nature and extent evaluation for groundwater were collected at monitoring wells distributed throughout FCS, at the water supply wells in Building 3559, and from borings advanced north of FCS during the 2009 northern plume investigation. Due to the age, MDL, and sample coverage issues described in Section 3.2.5, only samples collected during the five most recent sampling events at FCS (fall 2007, spring 2008, fall 2008, spring 2009, and fall 2009) and from the 2009 northern plumes and 1,2,3-trichloropropane investigation were considered in the evaluation. Sample locations are shown in Figure 3-7. Full listings of the analytical results for the evaluation group are provided in Appendix I.

Samples used to evaluate soil-gas concentrations and distribution patterns were collected from the vadose zone (upper 6 feet) soil borings in open areas throughout FCS and from subslab soil-gas ports installed in garages of each building. All detected results for the vadose zone soil gas samples from fall 2007 were considered, as were the subslab soil gas samples from the December 2008 and August 2009 events. Sample locations are shown in Figure 3-8 and full listings of the analytical data for the evaluation group are provided in Appendix I.

Samples used to evaluate the possible impact of residual soil contamination on groundwater are the same soil samples used in the surface and subsurface soil samples used in the nature and extent of soil contamination evaluations.

The PSLs for soil, groundwater, and soil gas are listed in Tables 3-1 through 3-3. The migration-to-groundwater screening levels are listed in Table 3-4.

5.1 Chemicals of Interest

The COI identification process for the nature and extent evaluation involved simple comparisons of summarized analytical results for all media of interest to their respective PSLs. Any target analyte with one or more exceedances of a PSL was identified as a possible COI for that medium. The migration-to-groundwater screening levels were not used to identify COIs because actual groundwater data were available to identify groundwater COIs.

Note that the COI selection process is used only to distill the full list of detected analytes for a medium into a more manageable and relevant (with respect to conservative risk-based values) number of chemicals for mapping and distribution analysis. Separate evaluation processes that take into account all results for each sample are used to select COPCs for the risk assessments.

5.1.1 Surface Soil COIs

Thirteen target analytes were identified as possible COIs for surface soil on the basis of having one or more samples with an exceedance of a PSL (Table 5-1). Of these 13 analytes, four were organic chemicals that were also detected above PSLs in possible source materials removed from FCS (see Section 4.2). These co-detected organic chemicals are

- 1,2,4-Trichlorobenzene
- Benzo(a)pyrene
- TCE
- GRO

The other possible COIs (aluminum, antimony, arsenic, chromium, cobalt, copper, iron, lead, and manganese) are naturally occurring metals detected throughout FCS, and although these concentrations exceed PSLs, the maximum concentrations detected for all of the possible metal COIs, except arsenic, are below their actual Method 2 cleanup levels. The PSL for arsenic is the 95 percent upper conference limit (UCL) that was calculated for arsenic using soil samples collected across Fort Wainwright. An evaluation conducted in 2009 compared the distribution of arsenic in FCS soils with the distribution of arsenic in soils used to generate the background value. This evaluation found the two data sets to be statistically similar (see Appendix K). The broad distribution of exceedances, the low magnitudes of exceedance, and the statistical similarity of arsenic levels in FCS soil to those in the background data set, coupled with the absence of any evidence of widespread use of metal-containing chemicals at FCS, indicate that metals found in soil at FCS are not the result of FCS operations or releases. Consequently, this section does not include an evaluation of the nature and extent of the nine metals identified as possible COIs for surface soil. Note, however, that metals are carried forward in the risk assessment process regardless of their treatment in the nature and extent evaluation.

5.1.2 Subsurface Soil COIs

Nineteen target analytes were identified as possible COIs for subsurface soil on the basis of having one or more samples with an exceedance of a PSL (Table 5-2). Of these 19 possible COIs, 11 were organic chemicals that for the most part were also detected above PSLs in possible source materials removed from FCS (see Section 4.2):

- 1,2,3-Trichloropropane
- Chloroform (not detected above PSLs in source characterization group)
- TCE
- DRO
- GRO
- RRO
- n-Nitrosodimethylamine (not detected in source characterization group)
- n-Nitrosodi-n-propylamine (not detected in source characterization group

- 4,4′-DDT
- Benzo(a)pyrene
- Dibenz(a,h)anthracene

The nature and extent of the possible metal COIs (aluminum, arsenic, chromium, cobalt, copper, iron, lead, and manganese) for subsurface soil are not evaluated for the same reasons presented for metals in surface soil. Note, however, that metals are carried forward in the risk assessment process regardless of their treatment in the nature and extent evaluation.

5.1.3 Groundwater COIs

Twenty-five target analytes were identified as possible COIs for groundwater on the basis of having one or more samples with an exceedance of a PSL (Table 5-3). Of these 25 analytes, 18 were organic chemicals that, for the most part, were also detected in or are degradation products in possible source materials removed from FCS (see Section 4.2), or were detected in soil:

- 1,1,2,2-Tetrachloroethane
- 1,1,2-Trichloroethane
- 1,1-Dichloroethene
- 1,2,3-Trichloropropane
- Benzene
- cis-1,2-Dichloroethene
- PCE
- TCE
- Vinyl chloride
- DRO
- RRO
- bis-(2-Ethylhexyl)phthalate
- Dieldrin
- gamma-BHC
- Heptachlor
- Benzo(a)pyrene
- Dibenzo(a,h)anthracene
- Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)

The remaining possible COIs are naturally occurring metals (antimony, arsenic, cobalt, iron, nickel, selenium, and thallium). As with soil, concentrations of the maximum detected concentrations for most possible metal COIs were below actual ADEC Method 2 cleanup levels, and exceedances of the PSLs were infrequent and scattered across FCS. The exception is cobalt, with several exceedances of the ADEC Method 2 value. However, all of the detected concentrations were below the maximum detected background concentration for cobalt in Fairbanks-area groundwater (32 μg/L) reported by the USGS (2001). Consequently, the nature and extent of the possible metal COIs for groundwater are not evaluated in this section. Note, however, that metals are carried forward in the risk assessment process regardless of their treatment in the nature and extent evaluation.

5.1.4 Soil-Gas COIs

Sixteen VOCs were identified as possible COIs for soil gas on the basis of having one or more samples with an exceedance of a PSL (Table 5-4). The possible COIs for soil gas are similar to those found in source material or soil and groundwater samples:

- 1,1-Dichloroethene
- 1,2,3-Trichloropropane
- 1,2,4-Trichlorobenzene
- 1,2,4-Trimethylbenzene
- 1,2-Dichloroethane
- Carbon tetrachloride
- Chloroform
- Ethylbenzene
- Hexachlorobutadiene
- Naphthalene

- 1,2-Dichloropropane
- 1,3,5-Trimethylbenzene
- Bromomethane
- PCE
- TCE
- Xylenes

5.1.5 COI Groupings for the Nature and Extent Evaluation

Since many of the analytes identified as COIs are related to particular types of chemicals or fuels, chemically similar or related COIs have been grouped together for discussion purposes, as follows:

- PCBs (Aroclor 1260)
- Petroleum and petroleum-related chemicals (DRO, RRO, GRO, BTEX, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and PAHs)
- Chlorinated VOCs (1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloropropane, 1,2,4-trichlorobenzene, carbon tetrachloride, chloroform, cis-1,2-dichloroethene, hexachlorobutadiene, PCE, TCE, and vinyl chloride)
- 1,2,3-trichloropropane
- Explosives (RDX)
- Pesticides (4,4'-DDT, dieldrin, gamma BHC, and heptachlor)
- SVOCs (bis-(2-ethylhexyl)phthalate, n-nitrosodimethylamine, and n-nitrosodi-n-propylamine)

The evaluation of the nature and extent of contamination is organized according to these groupings.

5.2 Sound Berm Evaluation

The objective of the 2007 sound berm sampling program was to determine whether sound berm soils contain elevated concentrations of target analytes that might require further delineation to support future baseline risk assessment evaluations. The sound berm characterization process involved comparing the MI decision unit samples results (adjusted to account for 95UCL values for the triplicate sample) to the soil screening levels used to identify data gaps in 2007. If the concentrations of target analytes in an MI decision unit exceed these criteria, a follow-up sampling program consisting of discrete surface soil samples needed to be conducted to obtain appropriate data for use in risk assessment.

The data used to calculate the 95UCL values for the triplicate samples (collected at DB09) are listed, along with adjustment factors for the other MI samples, in Appendix I. A 95UCL and adjustment factor was calculated only if an analyte was detected in at least one of the three triplicate samples. If an analyte was not detected in all three samples, then the 95UCL calculations used the MDL for the non-detects was used as a proxy value.

The 95UCL-adjusted results for the sound berm decision unit samples are summarized and compared to the 2007 screening levels in Table 5-5. The table lists the number of samples collected (triplicates are represented as one sample because the 95UCL value replaces the three original sample results), the number of detections, the ranges of detected concentrations and MDLs, and the results of the screening level comparisons for both detects and nondetects.

As shown in Table 5-5, concentrations of benzo(a)pyrene in two sound berm MI decision units (DB04 and DB06) exceeded the screening level of 0.015 mg /kg used in 2007.[3] Therefore, additional discrete surface soil samples were needed from these decision units to support evaluation of possible risk associated with benzo(a)pyrene in surface soil during the baseline risk assessment. These discrete samples were collected in 2008 and 2009 and are included in the data set used to evaluate the nature and extent of contamination and assess risk. MI results for the other sound berm decision units were below the 2007 soil screening levels so no follow-up sampling was required.

5.3 Nature and Extent of COIs

The distribution of each COI or COI group in discrete soil, groundwater, and soil gas is discussed in the following sections and depicted in Figures 5-1 through 5-20. As detailed in Section 3.2.7, colors in the distribution figures indicate the magnitude of PSL exceedance at each sample location, as follows:

- **White:** COI(s) not detected, or all detected results less than the PSL(s)
- **Green:** one or more detected result greater than 1 and less than or equal to 10 times the PSL
- **Yellow:** one or more detected result greater than 10 and less than or equal to 100 times the PSL
- **Red:** one or more detected result greater than 100 times the PSL

If multiple COIs at a location exceeded PSLs, the COI with the highest magnitude result determined the color code for the location. Similarly, if more than one set of sample results for a location (such as monitoring wells with multiple sample results) exceeded a PSL, the highest-magnitude result determined the color code for the location. Labels were added to indicate the analytes, sample depths (or sample dates), and concentrations reported for each analyte that exceeded a PSL.

5.3.1 PCBs

PCBs were not identified as COIs in any medium at the FCS. This is because, as documented in Sections 2.3 and 4, all soils with concentrations of PCBs in excess of the 1-mg/kg action level were excavated and properly disposed of during the course of the removal action and other RI activities. The sample sets used to evaluate the nature and extent of contamination only contain confirmation samples collected following completion of excavation activities. Nonetheless, since the presence of PCBs in FCS soil has been a major driver for the RI and PCBs were identified as COIs for source material (see Section 4), the nature and extent of residual PCB contamination is discussed below.

[3] The current PSL for benzo(a)pyrene is 0.049 mg/kg, none of the 95% UCL values for the sound berm MI samples exceeded this value.

The distribution of PCB exceedances remaining in FCS soil is depicted in Figures 5-1 (surface soil) and 5-2 (subsurface soil). No exceedances of the 1-mg/kg PSL for PCBs were identified in the surface soil or subsurface soil sample groups. One subsurface soil collected in the vicinity of Building 52 contained 15 mg/kg of Aroclor 1260 (Figure 5-2). This sample was obtained from the floor of an excavation, at a depth of 12.5 feet bgs. The affected soil was removed (accordingly, the analytical results for the sample are part of the source evaluation group discussed in Section 4); however, a sample could not be collected to confirm the removal because groundwater entered the excavation and subsequently froze. A monitoring well was installed at this location in 2008 to acquire the missing confirmation sample and gauge the potential for PCBs in groundwater at this location. None of the soil samples collected from the borehole nor the groundwater sample collected at the well contained elevated concentrations of PCBs.

5.3.2 Petroleum and Petroleum-Related Chemicals

The distributions of petroleum and petroleum-related chemical exceedances in surface soil, subsurface soil, groundwater, and soil gas (VOCs only) are depicted in Figures 5-3 through 5-9.

Surface Soil

One exceedance of the PSL for GRO and three exceedances of the PSL for benzo(a)pyrene were identified in surface soil, as indicated by green symbols in Figures 5-3 and 5-6. The levels of GRO and benzo(a)pyrene in the samples were below the ADEC Method 2 cleanup level, and no other exceedances of PSLs for other COIs were identified in the samples.

Subsurface Soil

DRO, GRO, and RRO were detected above their PSLs in several subsurface soil samples collected in FCS. The locations of the exceedances are identified by green and orange symbols in Figure 5-4. The DRO exceedances occur primarily in the north-central portion of FCS where petroleum contamination was identified and removed during housing construction. The highest-magnitude exceedances for DRO occurred at depths of 12 to 16 feet bgs, depths that are unlikely to have been reached during removal of the contaminated soil. The RRO and GRO exceedances are scattered around FCS and the levels of RRO and GRO were below the ADEC Method 2 cleanup level, with no other coinciding PSL exceedances in the samples.

Several subsurface soil samples around FCS contained concentrations of benzo(a)pyrene and dibenz(a,h)anthracene at levels above their respective PSLs (Figure 5-7). One exceedance was located near Building 11, in the general vicinity of identified petroleum contamination, albeit in shallower soil than the DRO exceedances. The other exceedances occurred in confirmation samples collected from the Building 48 excavation. Concentrations of both chemicals in the three samples were below the ADEC Method 2 cleanup levels, and no exceedances of PSLs for other COIs were identified in the samples.

Groundwater

As shown in Figure 5-5, monitoring wells with elevated concentrations of DRO are located in the north-central portion of FCS, where petroleum-affected groundwater was suspected and petroleum-contaminated soil was removed. Consistent with the general groundwater flow direction, the petroleum-affected zone extends northward and was delineated by wells installed as part of the 2009 northern plume investigation. Petroleum hydrocarbons in the form of RRO were reported at concentrations above the PSL in groundwater samples obtained from several monitoring wells during the fall 2007 monitoring event. Most exceedances occurred in wells outside the petroleum-affected area, and the reported concentrations in the wells were J qualified. Similar results were not reported during subsequent sampling events. Regardless, all RRO exceedances were less than the ADEC Method 2 cleanup level, and the extent of the RRO-affected groundwater is bounded by the existing monitoring-well network.

Exceedances of the PSLs for benzo(a)pyrene and dibenz(a,h)anthracene occurred in three wells during several sampling events (Figure 5-8). One sample was collected from a well located within the petroleum-affected groundwater in the north-central portion of FCS (MW-62). The other two exceedances occurred in samples collected from wells in the eastern portion of FCS. The downgradient extent of both PAH-affected zones has been delineated by the existing monitoring well network.

Soil Gas

A few scattered exceedances of the PSLs for naphthalene co-occur with the petroleum-affected soil and groundwater (e.g., SG007-L and SG071) but, for the most part, soil-gas PSL exceedances for petroleum-related VOCs are isolated and do not appear to be collocated with elevated concentrations of petroleum or petroleum-related chemicals in soil and groundwater.

5.3.3 1,2,3-Trichloropropane

The distribution of 1,2,3-trichloropropane in surface soil, subsurface soil, groundwater, and soil gas are depicted in Figures 5-10 through 5-13. No exceedances of the PSL were identified in surface soil . The one subsurface soil exceedance of the PSL for 1,2,3-trichloropropane for soil occurred in a confirmation sample collected at a depth of 4 feet in the excavation at Building 22 and 24. The result is greater than the ADEC Method 2 cleanup level, but the extent of the contamination appears to be very limited as the sample is surrounded by other confirmation samples from the same and deeper depths without exceedances.

The distribution of 1,2,3-trichloropropane exceedances in groundwater are shown in Figure 5-12. Although exceedances are scattered around FCS, the higher-magnitude exceedances (greater than 10 times the PSL) are clustered in the east-central portion of FCS, north and east of the Buildings 22 and 24 excavation. Groundwater flow in this portion of FCS is typically to the north-northwest, and the downgradient extent of the 1,2,3-trichloropropane-affected groundwater in that direction has been determined by the existing well network. However, because several of the affected wells are located within the upper range pumping rate capture zone (i.e., the 1,700-gpm capture zone) for the FWA water supply wells, there is potential for north-northeasterly flow in this area. Therefore, a passive soil-gas and groundwater investigation was conducted in 2009 to better determine whether elevated concentrations of 1,2,3-trichloropropane extended into the more likely capture zone for the FWA water supply wells (see Section 2.1.5). The chemical was detected neither in the passive soil-gas samples nor in the monitoring wells installed between FCS and the FWA water supply wells. Based on these results, the 1,2,3-trichloropropane plume has been fully delineated and appears to be contained within FCS (i.e., there is no indication of plume movement toward the water supply wells). Furthermore, groundwater dilution calculations suggest that even if monitoring wells MW-08, MW-47, and MW-39 (the wells along the fringe of the capture zone for the 1,700-gpm pumping rate) were within the typical pumping rate capture zone for the water supply wells, the concentrations of 1,2,3-trichloropropane reported for these wells would be diluted by a factor of more than 100 by the time the groundwater reached the supply well (see Appendix B).

1,2,3-Trichloropropane was detected in only four of the 177 waste soil samples analyzed for the chemical, and the concentration in only one sample (06WA01) was above the soil PSL (see Section 4). The waste characterization sample was obtained from TP14 during the 2006 investigation. TP14 was located in the vicinity of Building 49 and is over 500 feet west of where the 1,2,3-trichloropropane plume is located.

The single 1,2,3-trichloropropane exceedance in soil gas at SG033-R does not coincide with the 1,2,3-trichloropropane-affected soil and groundwater in the vicinity of Buildings 22 and 24 or in the eastern part of the site (Figure 5-13).

5.3.4 Chlorinated VOCs

The distribution of chlorinated VOC exceedances in surface soil, subsurface soil, groundwater, and soil gas are depicted in Figures 5-14 through 5-17.

Surface Soil

Chlorinated VOC exceedances in surface soil are limited to scattered exceedances for TCE in three locations (two in Subarea D excavation confirmation samples, and one in a Building 1 excavation confirmation sample), as well as a single 1,2,4-trichlorobenzene exceedance north of Building 9 (Figure 5-14). All detected concentrations were below their respective ADEC Method 2 cleanup levels and did not coincide with exceedances for other COIs.

Subsurface Soil

TCE was detected above its respective PSL in several subsurface soil samples, with some clustering of PSL exceedances in the vicinity of the Buildings 22 and 24 excavation (Figure 5-15). All results were below the ADEC Method 2 cleanup level, and no patterns of occurrence suggesting possible unknown or unexplored source areas were identified. However, most of the samples with exceedances were obtained from sidewalls or floors of excavations, which suggests the presence of VOCs in soil and debris removed from the excavation.

Chloroform was also detected above its PSL in several isolated subsurface soil samples. As with TCE, all chloroform concentrations were below the ADEC Method 2 cleanup level, and the extent of any impacted soil has been determined.

Groundwater

The distribution of chlorinated VOC exceedances in groundwater is shown in Figure 5-16. Monitoring wells with concentrations of PCE, TCE, vinyl chloride, and related breakdown products in excess of PSLs during one or more sampling events are indicated by colored symbols. The samples with the highest concentrations (up to 100 times the PSL for TCE) were collected at MW56 and MW61 in the central portion of FCS, between Buildings 14 and 49. Wells with lower, but still PSL-exceeding, concentrations of these chemicals are located north of this area and appear to be aligned with the overall north-northwesterly groundwater flow direction. The downgradient extent of the affected groundwater was established during the 2009 northern plume investigation by soil-boring grab samples, followed by installation of MW82, MW83, and MW84. Chlorinated VOCs have not been detected above PSLs in samples collected from the deep well (MW80) installed in the apparent source are. The chlorinated VOC plume is well outside of the water supply well capture zone.

Soil Gas

The large number of chlorinated VOCs detected above the soil-gas PSLs in a variety of locations at FCS did not allow for preparation of a legible figure depicting both exceedance locations and labels listing the results for all soil gas COIs. The predominant VOC with exceedances in soil gas was chloroform, with exceedances occurring throughout FCS and all exceedances being below the ADEC target level for shallow and subslab gas. The chloroform exceedances do not coincide with any areas of contaminated soil or groundwater at FCS, and there is no apparent source for chloroform at FCS. The distribution of the chlorinated VOC exceedances in soil gas also appears to be random, with higher-magnitude exceedances occurring in open areas and beneath buildings well away from the chlorinated VOC-affected soil and groundwater in the northern part of FCS.

5.3.5 Pesticides, Explosives, and SVOCs

Pesticides, explosives, and SVOCs are grouped together because the number of samples with exceedances of PSLs for these groups is very limited. The distributions of these exceedances are shown in Figures 5-18 through 5-20.

Surface Soil

As shown in Figure 5-18, no pesticide, explosive, or SVOC exceedances occurred in surface soil.

Subsurface Soil

The 4,4’-DDT exceedances in subsurface soil at the Building 11 and Subarea D excavations shown in Figure 5-19 represent samples concentrations just above the PSL and below the ADEC Method 2 cleanup level. These sample locations are surrounded by locations without exceedances.

N-nitrosodi-n-propylamine (NNSPR) and n-nitrosodimethylamine (NNSM) were detected above their PSLs near Building 48 in the central portion of FCS and near Buildings 8 and 10 in the north-central portion of the FCS (Figure 5-19). The NNSPR and NNSM exceedances near Building 48 occurred in a sample collected at 7 feet bgs, at the bottom of an excavation at Building 48. The NNSPR exceedances in the vicinity of Buildings 8 and 10 occurred in samples collected at depths of 12 and 16 feet bgs during the PSE II. Both chemicals are unlikely to have been used in any quantity at FCS, since they are mainly chemicals produced in small amounts for research and may also be byproducts of certain manufacturing processes (cosmetics, rubber products, and for a short time, rocket fuel) (ASTDR, 1999a, b). None of these manufacturing processes occurred at the FCS so it is unlikely that materials containing these chemicals would have been buried or disposed of at the site. The samples in the vicinity of Buildings 8 and 10 were collected at and below the water table. Groundwater in this area is contaminated with DRO; detection of NNSPR may be the result of interferences from the petroleum.

Groundwater

Heptachlor, dieldrin, and RDX were detected above their respective PSLs in samples collected from several wells located in the north-central portion of FCS (Figure 5-20). The pesticide and explosive exceedances are collocated with the highest magnitude exceedances for DRO in groundwater. The extent of the affected groundwater has been delineated.

Bis(2-ethylhexyl)phthalate was detected above its PSL in samples collected from several monitoring wells located in the eastern part of FCS during the fall 2008 sampling event. Concentrations of the SVOC were all below the ADEC Method 2 cleanup level and the PSL-exceeding concentrations were not repeated during subsequent sampling events.

5.3.6 Uncertainties Associated with Nature and Extent Characterization

Several factors are key to reducing uncertainty in the nature and extent evaluations. These factors include sample coverage, target analyte completeness, and the ability of analytical methods to detect target analytes at levels of possible concern. The remedial investigation for the FCS was designed to provide extensive soil sample coverage to characterize contaminants remaining in FCS soil following completion of the PCB removal action and drum and debris investigations, and to characterize possible impacts on groundwater and soil gas. Because of the history of investigations and removal actions completed at the FCS, soil sampling strategies have been both judgmental and systematic across the FCS. Judgmental samples were collected, for example, as confirmation samples at targeted drum and debris removal areas where geophysical anomalies were observed and at known or suspected contaminant hot spot areas. Systematic samples, such as the surface soil samples obtained from the yards of the residences, were collected at locations and depths where sources and/or contaminants were thought to be absent. Because the sampling was roughly evenly spaced with high spatial density across the FCS, and soil was analyzed for all suspected contaminants, it is anticipated that the data generally reflect the nature and extent of contamination at the FCS. The target analyte lists for the samples included a wide range of analytes tailored to the types of wastes and chemicals thought to be present at the FCS. In most cases, target analyte MDLs were consistent with the PSLs being used to determine the nature and extent of contamination at the FCS. For extent samples, this means that the MDLs were sufficiently low to conclude that a target analyte is not present at concentrations of concern and that the extent of contamination has been delineated. As indicated in Section 3.2.6, the MDLs for several analytes in soil and groundwater were consistently higher (i.e., greater than 50 percent of samples) than their respective PSLs because of limitations of analytical methods. The target analytes with MDL issues are indicated by italics in Tables 5-1 through 5-3, as discussed below:

- For surface soil, the maximum non-detect MDLs for two analytes (1,2,3-trichloropropane and 1,2-dibromo-3-chloropropane) also exceeded the Method 2 CUL or RSL that the PSL was derived from. Neither chemical was detected in surface soil, and the MDLs for almost half of the surface soil samples were below the PSL. Therefore, it is unlikely that the elevated MDLs for these analytes mask contamination that requires delineation. Nonetheless, potential risks associated with these chemicals are considered in the risk assessment (see Section 7).

- For subsurface soil, the maximum nondetect MDLs for three analytes (1,2-dibromo-3-chloropropane, 2-methyl-4,6-dinitrophenol, and NNSM) also exceeded the Method 2

CUL or RSL that the PSL was based on. The elevated MDLs for these chemicals are unlikely to have masked contamination that requires delineation. This is because the first two chemicals were not detected in any subsurface soil samples and are unlikely to have been used or disposed of at the FCS. And, as discussed in Section 5.3.5, although NNSM was detected in one subsurface soil sample, the chemical is not associated with operations or the types of waste disposed of at the FCS, and its detection may be the result of interferences from other chemicals in the area. Potential risks associated with these chemicals are considered in the risk assessment (see Section 7).

- For groundwater, the maximum non-detect MDLs for 20 analytes (see Table 5-2) also exceeded the Method 2 CUL or RSL that the PSL was derived from. Most of these chemicals were not detected in any groundwater samples and are unlikely to have used or disposed of at the FCS. Four analytes (1,2,3-trichloropropane, bis(2-ethylhexyl)phthalate, and dieldrin) were detected in groundwater and were identified as COIs for groundwater. As evidenced by the minimum MDLs for these analytes (Table 5-2), the analytical methods used for certain sampling were capable of detecting concentrations of these chemical at levels quite close to the PSLs (e.g., the minimum MDL for 1,2,3-tricholopropane is 0.014 µg/L relative to a PSL of 0.012 µg/L). Therefore, it is unlikely that elevated MDLs mask contamination that requires further delineation. Potential risks associated with these chemicals are considered in the risk assessment (see Section 7).

5.4 Migration to Groundwater Evaluation

Concentrations of target analytes in surface and subsurface soil were compared the groundwater protection screening levels in Table 3-4 to evaluate possible correlation of COI concentrations in soil with those of groundwater and to identify areas within FCS where soils may not be excavated and used as fill elsewhere.

Tables 5-5 and 5-6 summarize comparisons of surface and subsurface soil sample results to the migration to groundwater screening levels. In general, the lists of analytes with exceedances of the migration to groundwater screening levels do not match the list of chemicals actually detected above the groundwater PSLs during extensive groundwater sampling at FCS. The following chemicals do not appear in the list of COIs for groundwater:

- 1,2-Dibromoethane
- 1,2-Dichloroethane
- 1,2-Dichloropropane
- 1,2,4-Trichlorobenzene
- 2-Hexanone
- Chloroform
- Dibromochloromethane
- m,p-Xylene
- Methylene chloride
- 4-Chloroaniline
- 4-Nitroaniline
- bis-(2-Chloroethoxy)methane
- bis-(2-Chloroethyl)ether

- bis-(2-Chloroisopropyl)ether
- Hexachlorobenzene
- n-Nitrosodimethylamine
- n-Nitrosodi-n-propylamine
- Pentachlorophenol
- beta-BHC
- Aroclor 1260
- 2,4,5-T
- Propanol
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene

Only 1,1,2-trichloroethane, 1,2,3-trichloropropane, benzene, DRO, RRO, GRO, TCE, PCE, vinyl chloride, and gamma BHC (lindane) are shared among the lists, and the distribution of groundwater impacts predicted by the migration to groundwater screening level exceedances in soil is far more extensive than has actually been measured in groundwater at FCS. Figure 5-21 compares the extent of Aroclor 1260, DRO, and TCE migration to groundwater-screening level exceedances in soil to the extent of PCB-, DRO-, and TCE-impacted groundwater at FCS, and there is very little correlation outside of the higher-level exceedances for DRO in subsurface soil. Nonetheless, soil in the areas encompassed by the exceedances in Figure 5-21 would be considered contaminated and, if excavated, would not be usable for fill in areas where surface water is present.

5.5 Updated CSM

The preliminary CSM described in Section 3.1 and depicted in Figure 3-1 has been updated to reflect the findings of the source characterization and nature and extent of contamination findings. A schematic of the updated CSM is depicted in Figure 5-22. A cross-section depicting subsurface stratigraphy and contaminant distributions between MW-05 and MW-08 is presented in Figure 5-23.

5.5.1 Source Characterization and Nature and Extent of Contamination Findings

Sources

A variety of buried metal and debris, including empty drums, some drums with contents, and munitions-related items was found at the surface and in the subsurface at FCS. The debris, along with associated contaminated soil, tended to be concentrated in former low-lying areas (such as the former channel of Hoppe's Slough) and in pits that were filled and covered before FCS was developed. These source areas appear to be related to historical uses of the area for salvage, housing, and offices. Materials and chemicals placed in these former disposal areas and chemicals released at the surface (such as PCBs from transformers) are assumed to be the primary sources of contaminated soil and groundwater at FCS. The possible firefighter-training area in the northern portion of the salvage yard near Buildings 21 and 23 did not appear to be a source of contaminants, since only limited evidence of burning was found in nearby excavations, and soil and groundwater beneath the area were not affected by petroleum, solvents, or other chemicals typically associated with firefighter-training areas.

All significant potential disposal and contaminant source areas at FCS have been investigated. Accessible buried debris, munitions-related items, and contaminated soil encountered in these areas were removed and appropriately disposed of during the course of the RI and the PCB removal action. Minor amounts of metal debris remain beneath several buildings at FCS. However, the presence of such materials is not a direct indication that chemical contamination is present; in most locations, only limited volumes of contaminated soil were associated with subsurface debris. In addition, subslab soil gas sampling conducted at each of the residences has not detected evidence of significant soil contamination beneath any building, including those where debris may be present.

Surface Soil

Very few PSL exceedances were identified in surface soil at FCS. The magnitudes of exceedance for the surface soil COIs were low (less than 10 times their respective PSLs). Samples with exceedances occurred primarily along the sidewalls of excavations, indicating that while there may have been surface sources present in the area in the past, only residual, low levels of contamination remain. No previously unidentified sources of surface contamination were identified.

Subsurface Soil

Eleven COIs were identified in subsurface soil at FCS. The higher-level exceedances tend to be concentrated beneath and around portions of FCS where contaminated soil and debris were removed during pre-RI or RI field activities, indicating that only residual contamination beneath these areas remains. No previously unidentified sources of contamination were identified.

Groundwater

The nature and extent of COIs in groundwater are consistent with the locations and types of contaminant sources found and removed at FCS:

- **Petroleum:** The primary area of petroleum-affected groundwater extends along the direction of groundwater flow from an area between Buildings 7 and 9, where petroleum-contaminated soils were removed, northward beneath the SAS building and to Neely Road. The petroleum-affected zones are not located within the capture zone for the FWA water supply wells.

- **Chlorinated VOCs:** A long, somewhat narrow zone of TCE- and PCE-affected groundwater appears to originate just north of Building 48 and extends northward to FCS boundary with Neely Road. Other chlorinated organic compounds, which may be degradation products for TCE and PCE, are also present in the plume. The plume is not located within the capture zone for the FWA water supply wells

- **1,2,3-Trichloropropane:** 1,2,3-trichloropropane was detected at concentrations above the PSL in several monitoring wells located within the 1,700 gpm capture zone for the water supply wells. The extent of the 1,2,3-trichloropropane-affected groundwater has been determined, the plume appears stable (analytical results provided on Figure 5-12 show little variation in concentration over time), and elevated concentrations of the chemical were not detected wells installed between the exceedance locations and the FWA water supply wells.

Analytical results for waste soil samples from locations near the apparent source areas for the groundwater plumes (as determined from groundwater concentration gradients) were evaluated to identify possible source/release relationships for the contaminant plumes. Aside from POL, there appeared to be little evidence of such relationships.

Soil Gas

There appears to be no correlation with exceedances of soil-gas PSLs and identified contaminant source areas or residual contamination in soil or groundwater at FCS.

5.5.2 Fate and Transport Considerations for Residual Buried Debris and COIs

This section provides a brief review of the fate and transport considerations for possible chemicals in residual buried debris beneath buildings and for COIs in soil and groundwater at FCS.

Residual Buried Debris

Pockets of buried debris appear to extend beneath at least five buildings at FCS and cannot be easily removed. Buried debris may also be present beneath six additional buildings (Table 4-9 and Figure 4-3). Concerns have been raised about whether the inaccessible debris beneath the buildings might contain intact drums of volatile chemicals that, if released, could pose a potential for exposure to future building residents through the indoor-air pathway.

It is the Army's opinion that the likelihood of an intact, solvent-filled drum remaining beneath a building is extremely low, if not zero. To help demonstrate this, the probability may be estimated considering the following data and assumptions:

- 1,058 drums were encountered within the 350 tons of debris removed during investigation activities. If we conservatively assume that the 1950s-era steel drums weigh 70 pounds each, we see that drums represented approximately 10 percent of the debris by weight.
- Of the 1,058 drums encountered, only eight drums (or 0.8 percent) were intact and contained measurable liquid.
- While none of the eight liquid-containing drums was filled with solvents, the Army believes it is conservative to assume that of any intact drums that might remain beneath a building, no more than 1 percent could reasonably be expected to be both full and containing a solvent.

Taken together, the product of these factors yields a conservative upper-bound probability of an intact, solvent-filled drum remaining beneath a building of no more than 8 in 1 million, or 8×10^{-6}. The Army believes that this estimate is both reasonable and very conservative given that the estimate is generated by an account of actual debris encountered, with only one exception: the assumption that there is as much as a 1 percent chance of there being an intact drum filled with solvent beneath a building. Since no such drum was ever encountered, the assumption could justifiably use 0 percent to represent the probability of a solvent-filled drum; in which case, there would be zero probability of a solvent-filled drum residing beneath a building.

The residual buried material at the FCS is not expected to become emergent in the future due to the presence of concrete slab foundations.

Petroleum-Related Chemicals

Petroleum-related chemicals, including DRO, GRO, RRO, and PAHs were detected in soil, groundwater, and soil gas at FCS. For the most part, the number of sample results with exceedances of the PSLs is limited, and concentrations are below the Method 2 cleanup levels. However, subsurface soil and groundwater in the vicinity of Buildings 7 through 9 and at MW77 are contaminated by DRO, naphthalene, and other PAHs. No evidence of a floating liquid-phase hydrocarbon layer has been observed in any monitoring wells at FCS. In addition, because most petroleum-contaminated soil encountered during construction and investigation activities has been removed from the FCS, it is unlikely the dissolved plume would expand.

Through time, DRO and petroleum-related constituents will naturally degrade through microbial activity and will ultimately produce nontoxic end products (for example, carbon dioxide and water); however, a residue consisting of heavier petroleum hydrocarbons of relatively low solubility and volatility will typically be left behind in the original source (spill) area (ASTM, 1998). On the basis of the apparent age of the release and the absence of the more volatile components (such as benzene), downgradient of the apparent source, it appears that the source has been depleted of its more mobile and soluble components. Because weathered diesel fuel contains relatively few volatile compounds, there is little possibility of impacts to indoor air.

Chlorinated Solvents

Chlorinated solvents such as TCE and PCE were detected in soil, groundwater, and soil gas at FCS. Breakdown products of chlorinated solvents, most notably vinyl chloride, were also detected in groundwater. The concentration gradients indicate that TCE- and PCE-contaminated groundwater appears to originate just north of Building 48 and extend northward to FCS boundary. Although TCE and PCE are volatile, there appears to be limited correlation between the presence of TCE and PCE exceedances in groundwater and exceedances in soil gas.

The source of the TCE- and PCE-affected groundwater plume is unknown. A number of potential sources of solvents, including metals salvage operations, took place in the area historically, and buried drums were found in the former slough channel near Building 48. The relatively low concentrations of TCE and PCE are not suggestive of an extensive release, and neither chemical was detected above its PSL in a deep well located in the apparent source area. Therefore, ongoing releases from a separate dense non-aqueous phase liquid (DNAPL) layer of solvent within the aquifer are not suspected.

TCE biodegrades under both anaerobic and aerobic conditions, with anaerobic processes being the more typical pathway for degradation. Under anaerobic conditions, chlorine atoms are sequentially removed to form less-chlorinated organics by reductive dechlorination, eventually resulting in ethylene and ethane. Chemicals formed along the reductive dechlorination pathway include vinyl chloride and cis-1,2-dichloroethene (Ellis and Anderson, 2006), both of which have been detected in groundwater at FCS. The presence of these chemicals suggests that conditions in groundwater at FCS are conducive to anaerobic biodegradation.

Chloroform

Chloroform concentrations in excess of the soil and soil gas PSLs were found in soil and soil-gas samples obtained throughout much of FCS. The source of the chloroform is unknown. Chloroform evaporates easily into the air, does not sorb to soil very well and can travel through soil to groundwater, where it can easily dissolve (ATSDR, 1997). Chloroform has only been detected in one groundwater sample collected at FCS, however.

1,2,3-Trichloropropane

A zone of 1,2,3-trichloropropane-affected groundwater was identified in the eastern portion of FCS, near the 1,700-gpm capture zone for the FWA water supply wells. Based on passive soil-gas sample data and groundwater data for wells installed between the 1,2,3-trichloropropane plume and the water supply wells, there is no indication of plume movement toward the water supply wells. 1,2,3-trichloropropane is a synthetic chemical and is mainly used to make other chemicals. It is also used as an industrial solvent, paint and varnish remover, and cleaning and degreasing agent. Presumably it was used as a cleaning and degreasing agent sometime in the history of operations at FCS. The chemical evaporates from surface water and surface soil, but can leach from deeper soil into groundwater where it slowly breaks down (ATSDR, 1995).

Pesticides

Localized zones of DDT-affected soil and heptachlor and dieldrin-affected groundwater were identified at FCS. DDT is a persistent contaminant, sorbs strongly to soil, and is broken down slowly by microorganisms to DDE and DDD. DDT and especially DDE build up in plants and in the fatty tissues of fish, birds, and other animals (ATSDR, 2002a). These pesticides do not dissolve easily in water, and elevated concentrations of the chemicals have not been detected in groundwater at FCS. Dieldrin and heptachlor also sorb strongly to soil and do not easily dissolve in water (ATSDR, 2002b, 2007). However, the only occurrences of these chemicals are in groundwater near the north-central portion of FCS, where DRO and other petroleum-related constituents are present.

TABLE 5-1

Comparison of Summarized Analytical Data to PSLs - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
VOC	1,1,1,2-Tetrachloroethane	mg/kg	--	175	0%	0.000098	0.012	--	--	1.9	Res RSL	--	--
VOC	1,1,1-Trichloroethane	mg/kg	18	175	10%	0.00015	0.0056	0.002	0.11	36	1/10th ADEC outdoor inhl	--	--
VOC	1,1,2,2-Tetrachloroethane	mg/kg	1	175	1%	0.000089	0.0091	0.017	0.017	0.55	1/10th ADEC outdoor inhl	--	--
VOC	1,1,2-Trichloroethane	mg/kg	--	175	0%	0.000088	0.0098	--	--	1.1	1/10th ADEC outdoor inhl	--	--
VOC	1,1-Dichloroethane	mg/kg	--	175	0%	0.000048	0.014	--	--	90	1/10th ADEC outdoor inhl	--	--
VOC	1,1-Dichloroethene	mg/kg	--	175	0%	0.00007	0.009	--	--	0.085	1/10th ADEC outdoor inhl	--	--
VOC	1,2,3-Trichlorobenzene	mg/kg	2	175	1%	0.00014	0.014	0.00078	0.013	4.9	1/10 Res RSL	--	--
VOC	*1,2,3-Trichloropropane*	*mg/kg*	*--*	*175*	*0%*	*0.00027*	*0.26*	*--*	*--*	*0.017*	*1/10th ADEC outdoor inhl*	*--*	*92*
VOC	1,2,4-Trichlorobenzene	mg/kg	1	180	1%	0.00022	0.029	6.2	6.2	4.1	1/10th ADEC outdoor inhl	1	--
VOC	1,2,4-Trimethylbenzene	mg/kg	8	175	5%	0.000093	0.0099	0.00013	0.031	4.9	1/10th ADEC outdoor inhl	--	--
VOC	*1,2-Dibromo-3-chloropropane*	*mg/kg*	*--*	*175*	*0%*	*0.00078*	*0.99*	*--*	*--*	*0.0054*	*Res RSL*	*--*	*97*
VOC	1,2-Dibromoethane	mg/kg	--	175	0%	0.00015	0.0095	--	--	0.06	1/10th ADEC outdoor inhl	--	--
VOC	1,2-Dichlorobenzene	mg/kg	1	180	1%	0.000063	0.045	0.0002	0.0002	4.5	1/10th ADEC outdoor inhl	--	--
VOC	1,2-Dichloroethane	mg/kg	2	175	1%	0.000054	0.012	0.0091	0.045	0.48	1/10th ADEC outdoor inhl	--	--
VOC	1,2-Dichloropropane	mg/kg	--	175	0%	0.000065	0.014	--	--	0.53	1/10th ADEC outdoor inhl	--	--
VOC	1,3,5-Trimethylbenzene	mg/kg	4	175	2%	0.00004	0.0086	0.00012	0.022	4.2	1/10th ADEC outdoor inhl	--	--
VOC	1,3-Dichlorobenzene	mg/kg	1	180	1%	0.00007	0.042	0.00019	0.00019	6.9	1/10th ADEC outdoor inhl	--	--
VOC	1,3-Dichloropropane	mg/kg	--	175	0%	0.000059	0.0065	--	--	160	1/10 Res RSL	--	--
VOC	1,4-Dichlorobenzene	mg/kg	1	180	1%	0.0001	0.047	0.011	0.011	3	1/10th ADEC outdoor inhl	--	--
VOC	2-Butanone	mg/kg	35	175	20%	0.0016	0.35	0.0034	0.1	2,330	1/10th ADEC outdoor inhl	--	--
VOC	2-Chlorotoluene	mg/kg	--	175	0%	0.000051	0.0083	--	--	160	1/10 Res RSL	--	--
VOC	2-Hexanone	mg/kg	--	175	0%	0.00078	0.2	--	--	21	1/10 Res RSL	--	--
VOC	2-Methyl-1-propanol	mg/kg	1	1	100%	--	--	0.01	0.01	2,300	1/10 Res RSL	--	--
VOC	4-Chlorotoluene	mg/kg	--	175	0%	0.000092	0.0068	--	--	550	1/10 Res RSL	--	--
VOC	4-Methyl-2-pentanone	mg/kg	--	175	0%	0.00024	0.57	--	--	210	1/10th ADEC outdoor inhl	--	--
VOC	Acetone	mg/kg	52	175	30%	0.0014	0.28	0.014	0.51	6,860	1/10th ADEC outdoor inhl	--	--
VOC	Benzene	mg/kg	18	175	10%	0.00014	0.0069	0.0013	0.4	1.1	1/10th ADEC outdoor inhl	--	--
VOC	Bromobenzene	mg/kg	--	175	0%	0.000092	0.011	--	--	30	1/10 Res RSL	--	--
VOC	Bromodichloromethane	mg/kg	--	175	0%	0.000044	0.32	--	--	1	1/10th ADEC outdoor inhl	--	--
VOC	Bromoform	mg/kg	--	175	0%	0.00025	0.32	--	--	42	1/10th ADEC outdoor inhl	--	--
VOC	Bromomethane	mg/kg	12	175	7%	0.00042	0.04	0.0031	0.043	1.4	1/10th ADEC outdoor inhl	--	--
VOC	Carbon Disulfide	mg/kg	36	175	21%	0.000053	0.01	0.000099	0.0059	25	1/10th ADEC outdoor inhl	--	--
VOC	Carbon tetrachloride	mg/kg	--	175	0%	0.000078	0.013	--	--	0.31	1/10th ADEC outdoor inhl	--	--
VOC	Chlorobenzene	mg/kg	1	175	1%	0.000054	0.017	0.0001	0.0001	20	1/10th ADEC outdoor inhl	--	--
VOC	Chloroethane	mg/kg	--	175	0%	0.0003	0.042	--	--	2.3	1/10th ADEC outdoor inhl	--	--
VOC	Chloroform	mg/kg	8	175	5%	0.000048	0.015	0.00024	0.15	0.32	1/10th ADEC outdoor inhl	--	--
VOC	Chloromethane	mg/kg	6	175	3%	0.000057	0.011	0.0003	0.16	2.5	1/10th ADEC outdoor inhl	--	--
VOC	cis-1,2-Dichloroethene	mg/kg	2	175	1%	0.000081	0.0091	0.0004	0.014	13	1/10th ADEC outdoor inhl	--	--
VOC	Dibromochloromethane	mg/kg	--	175	0%	0.00016	0.28	--	--	1.4	1/10th ADEC outdoor inhl	--	--
VOC	Dibromomethane	mg/kg	--	175	0%	0.00012	0.022	--	--	37	1/10th ADEC outdoor inhl	--	--
VOC	Dichlorodifluoromethane	mg/kg	17	175	10%	0.000072	0.017	0.01	0.037	38	1/10th ADEC outdoor inhl	--	--
VOC	Ethylbenzene	mg/kg	6	175	3%	0.000041	0.01	0.00063	0.024	11	1/10th ADEC outdoor inhl	--	--
VOC	Hexachlorobutadiene	mg/kg	--	180	0%	0.00017	0.035	--	--	0.38	1/10th ADEC outdoor inhl	--	--
VOC	Isopropylbenzene	mg/kg	--	175	0%	0.000031	0.0087	--	--	6.2	1/10th ADEC outdoor inhl	--	--
VOC	m,p-Xylene	mg/kg	8	175	5%	0.000093	0.022	0.00018	2.8	340	1/10 Res RSL	--	--
VOC	Methylene chloride	mg/kg	22	175	13%	0.00014	0.019	0.0016	6.1	16	1/10th ADEC outdoor inhl	--	--
VOC	Methyl-tert-butyl ether (MTBE)	mg/kg	2	174	1%	0.00008	0.025	0.00024	0.019	29	1/10th ADEC outdoor inhl	--	--
VOC	n-Butylbenzene	mg/kg	1	175	1%	0.000088	0.008	0.00016	0.00016	4.2	1/10th ADEC outdoor inhl	--	--
VOC	n-Propylbenzene	mg/kg	--	175	0%	0.000062	0.0099	--	--	4.2	1/10th ADEC outdoor inhl	--	--
VOC	o-Xylene	mg/kg	3	175	2%	0.000059	0.01	0.000076	0.0089	380	1/10 Res RSL	--	--
VOC	sec-Butylbenzene	mg/kg	--	175	0%	0.000065	0.008	--	--	4.1	1/10th ADEC outdoor inhl	--	--
VOC	Styrene	mg/kg	1	175	1%	0.000076	0.0075	0.00015	0.00015	20	1/10th ADEC outdoor inhl	--	--

TABLE 5-1

Comparison of Summarized Analytical Data to PSLs - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
VOC	tert-Butylbenzene	mg/kg	--	175	0%	0.000054	0.0053	--	--	7	1/10th ADEC outdoor inhl	--	--
VOC	Tetrachloroethene (PCE)	mg/kg	12	175	7%	0.00012	0.011	0.0057	0.088	1	1/10th ADEC outdoor inhl	--	--
VOC	Toluene	mg/kg	38	175	22%	0.000044	0.0074	0.0011	2.9	22	1/10th ADEC outdoor inhl	--	--
VOC	trans-1,2-Dichloroethene	mg/kg	--	175	0%	0.000048	0.48	--	--	16	1/10th ADEC outdoor inhl	--	--
VOC	Trichloroethene (TCE)	mg/kg	10	175	6%	0.00013	0.015	0.00029	0.081	0.057	1/10th ADEC outdoor inhl	3	--
VOC	Trichlorofluoromethane	mg/kg	8	175	5%	0.000054	0.013	0.00014	2.4	99	1/10th ADEC outdoor inhl	--	--
VOC	Vinyl Acetate	mg/kg	--	1	0%	0.029	0.029	--	--	150	1/10th ADEC outdoor inhl	--	--
VOC	Vinyl chloride	mg/kg	--	175	0%	0.000057	0.016	--	--	0.43	1/10th ADEC outdoor inhl	--	--
VOC	Xylenes, Total	mg/kg	--	26	0%	0.0324	0.0519	--	--	6.3	1/10th ADEC outdoor inhl	--	--
TPH	DRO	mg/kg	134	199	67%	1.4	7.06	0.6	360	1,025	1/10th ADEC - Ingestion	--	--
TPH	GRO	mg/kg	5	183	3%	0.772	5.3	0.61	850	140	1/10th ADEC - Ingestion	1	--
TPH	RRO	mg/kg	159	199	80%	3	50	3.4	860	1,000	1/10th ADEC - Ingestion	--	--
SVOC	1,2-Diphenylhydrazine	mg/kg	--	6	0%	0.015	0.015	--	--	0.61	Res RSL	--	--
SVOC	2,4,5-Trichlorophenol	mg/kg	1	155	1%	0.003	0.0893	0.011	0.011	650	1/10th ADEC - Direct Contact	--	--
SVOC	2,4,6-Trichlorophenol	mg/kg	--	155	0%	0.0018	0.11	--	--	46	1/10th ADEC - Direct Contact	--	--
SVOC	2,4-Dichlorophenol	mg/kg	--	155	0%	0.0018	0.0893	--	--	23	1/10th ADEC - Direct Contact	--	--
SVOC	2,4-Dimethylphenol	mg/kg	--	140	0%	0.0055	0.35	--	--	130	1/10th ADEC - Direct Contact	--	--
SVOC	2,4-Dinitrophenol	mg/kg	--	155	0%	0.036	1.4	--	--	16	1/10th ADEC - Direct Contact	--	--
SVOC	2-Chloronaphthalene	mg/kg	--	178	0%	0.0036	0.0893	--	--	470	1/10th ADEC - Direct Contact	--	--
SVOC	2-Chlorophenol	mg/kg	--	155	0%	0.0017	0.0893	--	--	51	1/10th ADEC - Direct Contact	--	--
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	155	0%	0.0017	1.4	--	--	0.61	1/10 Res RSL	--	37
SVOC	2-Methylphenol (o-Cresol)	mg/kg	--	155	0%	0.0034	0.12	--	--	320	1/10th ADEC - Direct Contact	--	--
SVOC	2-Nitroaniline	mg/kg	--	178	0%	0.0027	0.095	--	--	61	1/10 Res RSL	--	--
SVOC	3&4-Methylphenol	mg/kg	--	37	0%	0.051	0.7	--	--	35	1/10th ADEC - Direct Contact, p-cresol	--	--
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	171	0%	0.0037	0.7	--	--	1.1	1/10 Res RSL	--	--
SVOC	4-Chloro-3-methylphenol	mg/kg	--	154	0%	0.0021	0.0893	--	--	610	1/10 Res RSL	--	--
SVOC	4-Chloroaniline	mg/kg	--	178	0%	0.0021	0.12	--	--	9	1/10th ADEC - Direct Contact	--	--
SVOC	4-Nitroaniline	mg/kg	--	178	0%	0.0034	1.08	--	--	24	Res RSL	--	--
SVOC	Azobenzene	mg/kg	--	164	0%	0.0024	0.0893	--	--	5.1	Res RSL	--	--
SVOC	Benzoic acid	mg/kg	7	155	5%	0.096	0.859	0.11	0.859	31,700	1/10th ADEC - Direct Contact	--	--
SVOC	Benzyl alcohol	mg/kg	41	177	23%	0.0037	0.36	0.0037	0.2	610	1/10 Res RSL	--	--
SVOC	Benzyl butyl phthalate	mg/kg	10	178	6%	0.0015	0.0893	0.0023	0.055	290	1/10th ADEC - Direct Contact	--	--
SVOC	bis-(2-Chloroethoxy)methane	mg/kg	--	178	0%	0.0013	0.0893	--	--	18	1/10 Res RSL	--	--
SVOC	bis-(2-Chloroethyl)ether	mg/kg	--	178	0%	0.0024	0.0893	--	--	0.33	1/10th ADEC outdoor inhl	--	--
SVOC	bis(2-Chloroisopropyl)ether	mg/kg	--	178	0%	0.0012	0.0893	--	--	4.6	Res RSL	--	--
SVOC	bis-(2-Ethylhexyl)phthalate	mg/kg	49	179	27%	0.0017	0.0893	0.0037	0.52	22	1/10th ADEC - Direct Contact	--	--
SVOC	Carbazole	mg/kg	20	177	11%	0.0013	0.12	0.0014	0.037	29	1/10th ADEC - Direct Contact	--	--
SVOC	Dibenzofuran	mg/kg	5	178	3%	0.0013	0.0893	0.0014	0.011	20	1/10th ADEC - Direct Contact	--	--
SVOC	Diethyl phthalate	mg/kg	1	178	1%	0.0035	0.0893	0.36	0.36	6,190	1/10th ADEC - Direct Contact	--	--
SVOC	Dimethyl phthalate	mg/kg	--	179	0%	0.0018	0.0893	--	--	77,300	1/10th ADEC - Direct Contact	--	--
SVOC	Di-n-butyl phthalate	mg/kg	8	179	4%	0.0026	0.0893	0.0028	0.27	790	1/10th ADEC - Direct Contact	--	--
SVOC	Di-n-octyl phthalate	mg/kg	--	178	0%	0.0012	0.0893	--	--	310	1/10th ADEC - Direct Contact	--	--
SVOC	Hexachlorobenzene	mg/kg	--	178	0%	0.0021	0.0893	--	--	0.15	1/10th ADEC outdoor inhl	--	--
SVOC	Hexachlorocyclopentadiene	mg/kg	--	1	0%	0.026	0.026	--	--	0.2	1/10th ADEC outdoor inhl	--	--
SVOC	Hexachloroethane	mg/kg	--	178	0%	0.0022	0.097	--	--	6.5	1/10th ADEC - Direct Contact	--	--
SVOC	Isophorone	mg/kg	--	178	0%	0.0016	0.0893	--	--	530	1/10th ADEC - Direct Contact	--	--
SVOC	n-Nitrosodimethylamine	mg/kg	--	177	0%	0.0061	0.0893	--	--	0.016	1/10th ADEC - Direct Contact	--	43
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	178	0%	0.0032	0.0893	--	--	0.052	1/10th ADEC - Direct Contact	--	26
SVOC	n-Nitrosodiphenylamine	mg/kg	--	178	0%	0.0022	0.0893	--	--	75	1/10th ADEC - Direct Contact	--	--
SVOC	Pentachlorophenol	mg/kg	3	155	2%	0.0019	0.71	0.028	0.089	3.9	1/10th ADEC - Direct Contact	--	--
SVOC	Phenol	mg/kg	4	155	3%	0.0019	0.0893	0.0032	0.052	2,320	1/10th ADEC - Direct Contact	--	--
PESTICIDES	4,4'-DDD	mg/kg	167	188	89%	0.00011	0.0068	0.00013	1.81	3	1/10th ADEC - Direct Contact	--	--

TABLE 5-1

Comparison of Summarized Analytical Data to PSLs - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
PESTICIDES	4,4'-DDE	mg/kg	183	188	97%	0.000667	0.00355	0.00011	0.33	2.1	1/10th ADEC - Direct Contact	--	--
PESTICIDES	4,4'-DDT	mg/kg	185	187	99%	0.00339	0.00355	0.00043	1.6	2.1	1/10th ADEC - Direct Contact	--	--
PESTICIDES	Aldrin	mg/kg	--	188	0%	0.00015	0.053	--	--	0.03	1/10th ADEC - Direct Contact	--	2
PESTICIDES	alpha-BHC	mg/kg	2	188	1%	0.00011	0.053	0.00098	0.0014	0.12	1/10th ADEC - Direct Contact	--	--
PESTICIDES	beta-BHC	mg/kg	3	188	2%	0.00018	0.053	0.00036	0.00084	0.4	1/10th ADEC - Direct Contact	--	--
PESTICIDES	Dieldrin	mg/kg	8	188	4%	0.00014	0.0699	0.0002	0.0053	0.032	1/10th ADEC - Direct Contact	--	2
PESTICIDES	Endrin	mg/kg	--	188	0%	0.000094	0.0699	--	--	0.2	1/10th ADEC - Direct Contact	--	--
PESTICIDES	gamma-BHC (Lindane)	mg/kg	4	188	2%	0.00008	0.053	0.00016	0.00077	0.56	1/10th ADEC - Direct Contact	--	--
PESTICIDES	gamma-Chlordane	mg/kg	20	188	11%	0.000064	0.053	0.00012	0.012	1.6	Res RSL	--	--
PESTICIDES	Heptachlor	mg/kg	3	188	2%	0.00008	0.0699	0.000085	0.00055	0.13	1/10th ADEC - Direct Contact	--	--
PESTICIDES	Heptachlor epoxide	mg/kg	11	188	6%	0.000084	0.0699	0.00012	0.0016	0.063	1/10th ADEC - Direct Contact	--	2
PESTICIDES	Methoxychlor	mg/kg	21	188	11%	0.0001	0.0699	0.00013	0.0043	32	1/10th ADEC - Direct Contact	--	--
PESTICIDES	Toxaphene	mg/kg	--	188	0%	0.0048	1.69	--	--	0.75	1/10th ADEC - Direct Contact	--	4
PCBs	PCB-1016 (Aroclor 1016)	mg/kg	--	74	0%	0.0021	0.05	--	--	1	Site specific	--	--
PCBs	PCB-1221 (Aroclor 1221)	mg/kg	--	74	0%	0.0021	0.063	--	--	1	Site specific	--	--
PCBs	PCB-1232 (Aroclor 1232)	mg/kg	--	74	0%	0.0021	0.05	--	--	1	Site specific	--	--
PCBs	PCB-1242 (Aroclor 1242)	mg/kg	--	74	0%	0.0021	0.059	--	--	1	Site specific	--	--
PCBs	PCB-1248 (Aroclor 1248)	mg/kg	--	74	0%	0.0021	0.05	--	--	1	Site specific	--	--
PCBs	PCB-1254 (Aroclor 1254)	mg/kg	--	74	0%	0.0021	0.14	--	--	1	Site specific	--	--
PCBs	PCB-1260 (Aroclor 1260)	mg/kg	37	74	50%	0.0021	0.038	0.0053	0.83	1	Site specific	--	--
PAH	2-Methylnaphthalene	mg/kg	150	220	68%	0.00034	0.64	0.0003	0.028	28	1/10th ADEC - Direct Contact	--	--
PAH	Acenaphthene	mg/kg	42	220	19%	0.00016	0.9	0.00016	0.014	280	1/10th ADEC - Direct Contact	--	--
PAH	Acenaphthylene	mg/kg	11	220	5%	0.00022	0.48	0.00023	0.0024	280	1/10th ADEC - Direct Contact	--	--
PAH	Anthracene	mg/kg	61	220	28%	0.00022	0.59	0.00022	0.0616	2,060	1/10th ADEC - Direct Contact	--	--
PAH	Benzo(a)anthracene	mg/kg	153	220	70%	0.00016	0.63	0.0002	0.12	0.49	1/10th ADEC - Direct Contact	--	1
PAH	Benzo(a)pyrene	mg/kg	154	220	70%	0.00022	0.68	0.00024	0.091	0.049	1/10th ADEC - Direct Contact	3	3
PAH	Benzo(b)fluoranthene	mg/kg	161	220	73%	0.00048	1.8	0.00048	0.13	0.49	1/10th ADEC - Direct Contact	--	2
PAH	Benzo(g,h,i)perylene	mg/kg	125	220	57%	0.00023	0.58	0.00028	0.053	140	1/10th ADEC - Direct Contact	--	--
PAH	Benzo(k)fluoranthene	mg/kg	108	220	49%	0.0003	0.03	0.00034	0.047	4.9	1/10th ADEC - Direct Contact	--	--
PAH	Chrysene	mg/kg	167	220	76%	0.00035	0.86	0.00041	0.13	49	1/10th ADEC - Direct Contact	--	--
PAH	Dibenzo(a,h)anthracene	mg/kg	61	220	28%	0.00019	0.036	0.00026	0.019	0.049	1/10th ADEC - Direct Contact	--	--
PAH	Fluoranthene	mg/kg	173	220	79%	0.0003	0.27	0.00035	0.23	190	1/10th ADEC - Direct Contact	--	--
PAH	Fluorene	mg/kg	65	220	30%	0.00019	0.62	0.00019	0.11	230	1/10th ADEC - Direct Contact	--	--
PAH	Indeno(1,2,3-cd)pyrene	mg/kg	123	220	56%	0.00024	0.85	0.00032	0.073	0.49	1/10th ADEC - Direct Contact	--	2
PAH	Naphthalene	mg/kg	74	220	34%	0.00027	0.031	0.00035	0.19	2.8	1/10th ADEC outdoor inhl	--	--
PAH	Phenanthrene	mg/kg	185	220	84%	0.00033	0.65	0.00041	0.21	2,060	1/10th ADEC - Direct Contact	--	--
PAH	Pyrene	mg/kg	175	220	80%	0.00036	0.44	0.0004	0.19	140	1/10th ADEC - Direct Contact	--	--
OTHER - TIC	Pentane	mg/kg	3	3	100%	--	--	0.0052	0.011	87	1/10 Res RSL	--	--
OTHER - TIC	Propanal	mg/kg	1	1	100%	--	--	0.016	0.016	8	1/10 Res RSL	--	--
METALS	Aluminum	mg/kg	181	181	100%	--	--	4,500	41,100	7,700	1/10 Res RSL	153	--
METALS	Antimony	mg/kg	79	181	44%	0.03	0.22	0.0734	7.42	4.1	1/10th ADEC - Direct Contact	1	--
METALS	Arsenic	mg/kg	186	186	100%	--	--	2.73	25.5	8.46	FT WW Background	79	--
METALS	Barium	mg/kg	181	181	100%	--	--	60.9	304	2,030	1/10th ADEC - Direct Contact	--	--
METALS	Beryllium	mg/kg	181	181	100%	--	--	0.079	0.34	20	1/10th ADEC - Direct Contact	--	--
METALS	Boron	mg/kg	112	181	62%	0.9	1.4	0.8	15.8	1,600	1/10 Res RSL	--	--
METALS	Cadmium	mg/kg	181	181	100%	--	--	0.067	4.6	7.9	1/10th ADEC - Direct Contact	--	--
METALS	Chromium	mg/kg	181	181	100%	--	--	8.13	102	30	1/10th ADEC - Direct Contact	3	--
METALS	Cobalt	mg/kg	181	181	100%	--	--	4.09	16.7	2.3	1/10 Res RSL	181	--
METALS	Copper	mg/kg	181	181	100%	--	--	9.43	541	410	1/10th ADEC - Direct Contact	1	--
METALS	Iron	mg/kg	181	181	100%	--	--	8,840	39,100	5,500	1/10 Res RSL	181	--
METALS	Lead	mg/kg	179	181	99%	0.05	0.06	3.17	254	40	1/10th ADEC - Direct Contact	12	--
METALS	Manganese	mg/kg	181	181	100%	--	--	159	880	180	1/10 Res RSL	178	--

TABLE 5-1

Comparison of Summarized Analytical Data to PSLs - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
METALS	Mercury	mg/kg	158	181	87%	0.002	0.0137	0.008	0.24	1.8	1/10th ADEC outdoor inhl	--	--
METALS	Molybdenum	mg/kg	5	5	100%	--	--	0.36	0.96	39	1/10 Res RSL	--	--
METALS	Nickel	mg/kg	181	181	100%	--	--	10.8	39.3	200	1/10th ADEC - Direct Contact	--	--
METALS	Selenium	mg/kg	58	181	32%	0.149	0.8	0.163	0.93	51	1/10th ADEC - Direct Contact	--	--
METALS	Silver	mg/kg	178	181	98%	0.02	0.02	0.03	0.348	51	1/10th ADEC - Direct Contact	--	--
METALS	Strontium	mg/kg	5	5	100%	--	--	26.7	85.3	4,700	1/10 Res RSL	--	--
METALS	Thallium	mg/kg	84	181	46%	0.001	0.055	0.033	0.2	0.81	1/10th ADEC - Direct Contact	--	--
METALS	Vanadium	mg/kg	181	181	100%	--	--	15.9	55.3	71	1/10th ADEC - Direct Contact	--	--
METALS	Zinc	mg/kg	181	181	100%	--	--	20.6	2,040	3,040	1/10th ADEC - Direct Contact	--	--
HERBICIDES	2,4,5-T	mg/kg	--	113	0%	0.00057	0.022	--	--	61	1/10 Res RSL	--	--
HERBICIDES	2,4,5-TP (Silvex)	mg/kg	--	113	0%	0.0021	0.05	--	--	52	1/10th ADEC - Direct Contact	--	--
HERBICIDES	2,4-D	mg/kg	10	113	9%	0.0008	0.035	0.0037	0.014	86	1/10th ADEC - Direct Contact	--	--
HERBICIDES	2,4-DB	mg/kg	--	113	0%	0.0016	0.065	--	--	49	1/10 Res RSL	--	--
HERBICIDES	Dalapon	mg/kg	--	113	0%	0.0047	0.72	--	--	180	1/10 Res RSL	--	--
HERBICIDES	Dicamba	mg/kg	--	113	0%	0.00094	0.019	--	--	180	1/10 Res RSL	--	--
HERBICIDES	Dinoseb	mg/kg	--	113	0%	0.0023	0.034	--	--	6.1	1/10 Res RSL	--	--
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	113	0%	0.00089	2.9	--	--	3.1	1/10 Res RSL	--	--
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	16	0%	0.001	5.3	--	--	6.1	1/10 Res RSL	--	--
EXPLOSIVES	1,3,5-Trinitrobenzene	mg/kg	4	126	3%	0.009	0.0094	0.027	0.045	280	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	1,3-Dinitrobenzene	mg/kg	--	126	0%	0.027	0.055	--	--	0.71	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2,4,6-Trinitrotoluene	mg/kg	--	126	0%	0.012	0.022	--	--	4.4	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2,4-Dinitrotoluene	mg/kg	--	180	0%	0.0028	0.025	--	--	0.88	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2,6-Dinitrotoluene	mg/kg	--	180	0%	0.0028	0.033	--	--	0.89	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2-Amino-4,6-dinitrotoluene	mg/kg	--	126	0%	0.026	0.11	--	--	2	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2-Nitrotoluene	mg/kg	--	126	0%	0.028	0.089	--	--	2.6	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	3-Nitrotoluene	mg/kg	--	126	0%	0.0089	0.078	--	--	150	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	4-Amino-2,6-dinitrotoluene	mg/kg	--	126	0%	0.015	0.022	--	--	1.9	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	4-Nitrotoluene	mg/kg	--	126	0%	0.016	0.089	--	--	35	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	--	126	0%	0.037	0.044	--	--	7.2	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	126	0%	0.011	0.056	--	--	40	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	Nitrobenzene	mg/kg	1	180	1%	0.002	0.083	0.049	0.049	5.1	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	Nitroglycerin	mg/kg	--	4	0%	0.13	0.14	--	--	30	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	126	0%	0.029	0.033	--	--	460	1/10th ADEC - Direct Contact	--	--

Notes:

mg/kg = milligrams per kilogram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry
OTHER - TIC = Chemical detected in tentatively-identified compounds scan

Shaded = detected result exceeds screening criteria.
Italics = analyte with more than 50% non-detects with elevated MDLs

TABLE 5-2

Comparison of Summarized Analytical Data to PSLs - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
VOC	630-20-6	1,1,1,2-Tetrachloroethane	mg/kg	--	624	0%	0.000092	0.028	--	--	1.9	Res RSL	--	--
VOC	71-55-6	1,1,1-Trichloroethane	mg/kg	47	624	8%	0.00015	0.03	0.00024	0.1	36	1/10th ADEC outdoor inhl	--	--
VOC	79-34-5	1,1,2,2-Tetrachloroethane	mg/kg	5	624	1%	0.000073	0.0411	0.0086	0.017	0.55	1/10th ADEC outdoor inhl	--	--
VOC	79-00-5	1,1,2-Trichloroethane	mg/kg	2	624	0%	0.000083	0.026	0.015	0.13	1.1	1/10th ADEC outdoor inhl	--	--
VOC	75-34-3	1,1-Dichloroethane	mg/kg	--	624	0%	0.000048	0.026	--	--	90	1/10th ADEC outdoor inhl	--	--
VOC	75-35-4	1,1-Dichloroethene	mg/kg	--	624	0%	0.00007	0.04	--	--	0.085	1/10th ADEC outdoor inhl	--	--
VOC	87-61-6	1,2,3-Trichlorobenzene	mg/kg	6	624	1%	0.00014	0.0411	0.0019	0.034	4.9	1/10 Res RSL	--	--
VOC	*96-18-4*	*1,2,3-Trichloropropane*	*mg/kg*	*2*	*624*	*0%*	*0.00027*	*0.23*	*0.0013*	*0.5*	*0.017*	*1/10th ADEC outdoor inhl*	*1*	*176*
VOC	120-82-1	1,2,4-Trichlorobenzene	mg/kg	10	637	2%	0.00022	1.5	0.001	0.071	4.1	1/10th ADEC outdoor inhl	--	--
VOC	95-63-6	1,2,4-Trimethylbenzene	mg/kg	28	624	4%	0.000093	0.0214	0.00049	0.107	4.9	1/10th ADEC outdoor inhl	--	--
VOC	*96-12-8*	*1,2-Dibromo-3-chloropropane*	*mg/kg*	*--*	*624*	*0%*	*0.00015*	*0.48*	*--*	*--*	*0.0054*	*Res RSL*	*--*	*387*
VOC	106-93-4	1,2-Dibromoethane	mg/kg	4	624	1%	0.00011	0.025	0.00013	0.022	0.06	1/10th ADEC outdoor inhl	--	--
VOC	95-50-1	1,2-Dichlorobenzene	mg/kg	5	637	1%	0.000063	2.3	0.00088	0.06	4.5	1/10th ADEC outdoor inhl	--	--
VOC	107-06-2	1,2-Dichloroethane	mg/kg	8	624	1%	0.000054	0.022	0.0012	0.046	0.48	1/10th ADEC outdoor inhl	--	--
VOC	78-87-5	1,2-Dichloropropane	mg/kg	11	624	2%	0.000065	0.022	0.0026	0.21	0.53	1/10th ADEC outdoor inhl	--	--
VOC	108-67-8	1,3,5-Trimethylbenzene	mg/kg	21	624	3%	0.00004	0.0214	0.00008	0.82	4.2	1/10th ADEC outdoor inhl	--	--
VOC	541-73-1	1,3-Dichlorobenzene	mg/kg	3	637	0%	0.00007	2.1	0.0048	0.058	6.9	1/10th ADEC outdoor inhl	--	--
VOC	142-28-9	1,3-Dichloropropane	mg/kg	--	624	0%	0.000059	0.0214	--	--	160	1/10 Res RSL	--	--
VOC	106-46-7	1,4-Dichlorobenzene	mg/kg	8	637	1%	0.0001	2.4	0.0048	0.057	3	1/10th ADEC outdoor inhl	--	--
VOC	78-93-3	2-Butanone	mg/kg	103	624	17%	0.00099	0.27	0.0023	1.7	2,330	1/10th ADEC outdoor inhl	--	--
VOC	95-49-8	2-Chlorotoluene	mg/kg	--	624	0%	0.000051	0.0214	--	--	160	1/10 Res RSL	--	--
VOC	591-78-6	2-Hexanone	mg/kg	2	624	0%	0.00078	0.27	0.014	0.021	21	1/10 Res RSL	--	--
VOC	78-83-1	2-Methyl-1-propanol	mg/kg	7	7	100%	--	--	0.0053	0.01	2,300	1/10 Res RSL	--	--
VOC	106-43-4	4-Chlorotoluene	mg/kg	1	624	0%	0.000092	0.0214	0.012	0.012	550	1/10 Res RSL	--	--
VOC	108-10-1	4-Methyl-2-pentanone	mg/kg	3	624	0%	0.00024	0.45	0.0053	0.016	210	1/10th ADEC outdoor inhl	--	--
VOC	67-64-1	Acetone	mg/kg	215	621	35%	0.001	0.6	0.011	2	6,860	1/10th ADEC outdoor inhl	--	--
VOC	71-43-2	Benzene	mg/kg	143	651	22%	0.000065	0.015	0.00038	0.34	1.1	1/10th ADEC outdoor inhl	--	--
VOC	108-86-1	Bromobenzene	mg/kg	--	624	0%	0.000092	0.043	--	--	30	1/10 Res RSL	--	--
VOC	75-27-4	Bromodichloromethane	mg/kg	1	624	0%	0.000044	0.15	0.0005	0.0005	1	1/10th ADEC outdoor inhl	--	--
VOC	75-25-2	Bromoform	mg/kg	--	624	0%	0.000071	0.15	--	--	42	1/10th ADEC outdoor inhl	--	--
VOC	74-83-9	Bromomethane	mg/kg	6	624	1%	0.00032	0.126	0.00059	0.023	1.4	1/10th ADEC outdoor inhl	--	--
VOC	75-15-0	Carbon Disulfide	mg/kg	84	612	14%	0.000058	0.0849	0.00013	0.014	25	1/10th ADEC outdoor inhl	--	--
VOC	56-23-5	Carbon tetrachloride	mg/kg	--	624	0%	0.000078	0.028	--	--	0.31	1/10th ADEC outdoor inhl	--	--
VOC	108-90-7	Chlorobenzene	mg/kg	1	624	0%	0.000054	0.023	0.03	0.03	20	1/10th ADEC outdoor inhl	--	--
VOC	75-00-3	Chloroethane	mg/kg	--	624	0%	0.00023	0.126	--	--	2.3	1/10th ADEC outdoor inhl	--	--
VOC	67-66-3	Chloroform	mg/kg	154	624	25%	0.000048	0.0214	0.00017	0.75	0.32	1/10th ADEC outdoor inhl	5	--
VOC	74-87-3	Chloromethane	mg/kg	20	624	3%	0.000057	0.051	0.00019	0.019	2.5	1/10th ADEC outdoor inhl	--	--
VOC	156-59-2	cis-1,2-Dichloroethene	mg/kg	12	624	2%	0.000081	0.038	0.0079	0.029	13	1/10th ADEC outdoor inhl	--	--
VOC	124-48-1	Dibromochloromethane	mg/kg	1	624	0%	0.00014	0.14	0.044	0.044	1.4	1/10th ADEC outdoor inhl	--	--
VOC	74-95-3	Dibromomethane	mg/kg	--	624	0%	0.000087	0.03	--	--	37	1/10th ADEC outdoor inhl	--	--
VOC	75-71-8	Dichlorodifluoromethane	mg/kg	16	624	3%	0.000072	0.044	0.00188	0.036	38	1/10th ADEC outdoor inhl	--	--
VOC	100-41-4	Ethylbenzene	mg/kg	59	651	9%	0.000041	0.031	0.00021	0.2	11	1/10th ADEC outdoor inhl	--	--
VOC	87-68-3	Hexachlorobutadiene	mg/kg	4	637	1%	0.00017	1.8	0.0015	0.071	0.38	1/10th ADEC outdoor inhl	--	4
VOC	110-54-3	Hexane	mg/kg	1	1	100%	--	--	0.012	0.012	57	1/10th RSL for N, hexane	--	--
VOC	98-82-8	Isopropylbenzene	mg/kg	12	624	2%	0.000031	0.0214	0.00024	0.49	6.2	1/10th ADEC outdoor inhl	--	--
VOC	108-38-3/1	m,p-Xylene	mg/kg	106	624	17%	0.000093	0.0411	0.00017	1.4	340	1/10th RSL	--	--
VOC	75-09-2	Methylene chloride	mg/kg	70	624	11%	0.00012	0.0849	0.00174	3.2	16	1/10th ADEC outdoor inhl	--	--
VOC	1634-04-4	Methyl-tert-butyl ether (MTBE)	mg/kg	1	603	0%	0.00008	0.0328	0.00031	0.00031	29	1/10th ADEC outdoor inhl	--	--
VOC	104-51-8	n-Butylbenzene	mg/kg	2	624	0%	0.000088	0.023	0.0058	0.33	4.2	1/10th ADEC outdoor inhl	--	--
VOC	103-65-1	n-Propylbenzene	mg/kg	8	624	1%	0.000062	0.022	0.00029	0.031	4.2	1/10th ADEC outdoor inhl	--	--
VOC	95-47-6	o-Xylene	mg/kg	48	624	8%	0.000044	0.0304	0.000053	0.14	380	1/10 Res RSL	--	--
VOC	135-98-8	sec-Butylbenzene	mg/kg	2	624	0%	0.000065	0.0214	0.0027	0.016	4.1	1/10th ADEC outdoor inhl	--	--
VOC	100-42-5	Styrene	mg/kg	6	624	1%	0.000076	0.0214	0.00055	0.41	20	1/10th ADEC outdoor inhl	--	--
VOC	98-06-6	tert-Butylbenzene	mg/kg	2	624	0%	0.000054	0.0214	0.0053	0.007	7	1/10th ADEC outdoor inhl	--	--
VOC	127-18-4	Tetrachloroethene (PCE)	mg/kg	46	624	7%	0.000085	0.0214	0.0084	0.71	1	1/10th ADEC outdoor inhl	--	--
VOC	108-88-3	Toluene	mg/kg	228	651	35%	0.000044	0.0411	0.00075	1.5	22	1/10th ADEC outdoor inhl	--	--
VOC	156-60-5	trans-1,2-Dichloroethene	mg/kg	--	624	0%	0.000048	0.23	--	--	16	1/10th ADEC outdoor inhl	--	--

TABLE 5-2

Comparison of Summarized Analytical Data to PSLs - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
VOC	79-01-6	Trichloroethene (TCE)	mg/kg	55	624	9%	0.00013	0.026	0.00022	0.33	0.057	1/10th ADEC outdoor inhl	11	--
VOC	75-69-4	Trichlorofluoromethane	mg/kg	28	624	4%	0.000054	0.036	0.00024	1.1	99	1/10th ADEC outdoor inhl	--	--
VOC	76-13-1	Trichlorotrifluoroethane (Freon 113)	mg/kg	--	1	0%	0.014	0.014	--	--	75	1/10th ADEC outdoor inhl	--	--
VOC	108-05-4	Vinyl Acetate	mg/kg	--	17	0%	0.024	0.051	--	--	150	1/10th ADEC outdoor inhl	--	--
VOC	75-01-4	Vinyl chloride	mg/kg	1	624	0%	0.000057	0.033	0.02	0.02	0.43	1/10th ADEC outdoor inhl	--	--
VOC	1330-20-7	Xylenes, Total	mg/kg	19	133	14%	0.0039	0.173	0.015	0.442	6.3	1/10th ADEC outdoor inhl	--	--
TPH	PHCD	DRO	mg/kg	371	557	67%	0.3	7.85	0.36	15,000	1,025	1/10th ADEC - Ingestion	7	--
TPH	PHCG	GRO	mg/kg	37	512	7%	0.18	11	0.37	630	140	1/10th ADEC - Ingestion	2	--
TPH	TPH-Oil	RRO	mg/kg	403	527	76%	1.6	170	1.7	3,500	1,000	1/10th ADEC - Ingestion	1	--
SVOC	122-66-7	1,2-Diphenylhydrazine	mg/kg	--	40	0%	0.015	0.015	--	--	0.61	Res RSL	--	--
SVOC	95-95-4	2,4,5-Trichlorophenol	mg/kg	2	544	0%	0.00096	4.2	0.056	0.11	650	1/10th ADEC - Direct Contact	--	--
SVOC	88-06-2	2,4,6-Trichlorophenol	mg/kg	1	544	0%	0.0018	6.1	0.088	0.088	46	1/10th ADEC - Direct Contact	--	--
SVOC	120-83-2	2,4-Dichlorophenol	mg/kg	2	544	0%	0.0018	2.4	0.054	0.088	23	1/10th ADEC - Direct Contact	--	--
SVOC	105-67-9	2,4-Dimethylphenol	mg/kg	--	509	0%	0.0017	19	--	--	130	1/10th ADEC - Direct Contact	--	--
SVOC	51-28-5	2,4-Dinitrophenol	mg/kg	1	544	0%	0.036	76	0.04	0.04	16	1/10th ADEC - Direct Contact	--	5
SVOC	91-58-7	2-Chloronaphthalene	mg/kg	4	553	1%	0.0017	2.2	0.023	0.29	470	1/10th ADEC - Direct Contact	--	--
SVOC	95-57-8	2-Chlorophenol	mg/kg	2	544	0%	0.0016	2.5	0.045	0.073	51	1/10th ADEC - Direct Contact	--	--
SVOC	534-52-1	2-Methyl-4,6-dinitrophenol	mg/kg	--	544	0%	0.0017	76	--	--	0.61	1/10 Res RSL	--	395
SVOC	95-48-7	2-Methylphenol (o-Cresol)	mg/kg	1	544	0%	0.0017	6.7	0.073	0.073	320	1/10th ADEC - Direct Contact	--	--
SVOC	88-74-4	2-Nitroaniline	mg/kg	1	553	0%	0.0027	5.2	0.086	0.086	61	1/10 Res RSL	--	--
SVOC	108-39-4/106	3&4-Methylphenol	mg/kg	--	406	0%	0.0029	38	--	--	35	1/10th ADEC - Direct Contact, p-cresol	--	1
SVOC	91-94-1	3,3'-Dichlorobenzidine	mg/kg	--	547	0%	0.0037	38	--	--	1.1	1/10th ADEC - Direct Contact	--	11
SVOC	59-50-7	4-Chloro-3-methylphenol	mg/kg	4	527	1%	0.00088	1.6	0.022	0.095	610	1/10 Res RSL	--	--
SVOC	106-47-8	4-Chloroaniline	mg/kg	1	553	0%	0.0021	6.7	0.074	0.074	9	1/10th ADEC - Direct Contact	--	--
SVOC	100-01-6	4-Nitroaniline	mg/kg	1	553	0%	0.0034	4.3	0.11	0.11	24	Res RSL	--	--
SVOC	62-53-3	Aniline	mg/kg	--	5	0%	0.078	0.103	--	--	85	Res RSL	--	--
SVOC	103-33-3	Azobenzene	mg/kg	--	244	0%	0.0024	3.1	--	--	5.1	Res RSL	--	--
SVOC	65-85-0	Benzoic acid	mg/kg	10	529	2%	0.064	19	0.097	0.58	31,700	1/10th ADEC - Direct Contact	--	--
SVOC	100-51-6	Benzyl alcohol	mg/kg	35	536	7%	0.0025	20	0.0042	0.029	610	1/10 Res RSL	--	--
SVOC	85-68-7	Benzyl butyl phthalate	mg/kg	13	553	2%	0.0015	2.2	0.0021	0.1	290	1/10th ADEC - Direct Contact	--	--
SVOC	111-91-1	bis-(2-Chloroethoxy)methane	mg/kg	2	553	0%	0.0013	2.5	0.043	0.066	18	1/10 Res RSL	--	--
SVOC	111-44-4	bis-(2-Chloroethyl)ether	mg/kg	2	553	0%	0.0024	3.7	0.046	0.054	0.33	1/10th ADEC outdoor inhl	--	10
SVOC	108-60-1	bis(2-Chloroisopropyl)ether	mg/kg	1	553	0%	0.0012	3.7	0.053	0.053	4.6	Res RSL	--	--
SVOC	117-81-7	bis-(2-Ethylhexyl)phthalate	mg/kg	42	554	8%	0.0017	2.8	0.0018	4.4	22	1/10th ADEC - Direct Contact	--	--
SVOC	86-74-8	Carbazole	mg/kg	20	531	4%	0.0013	6.3	0.0015	0.11	29	1/10th ADEC - Direct Contact	--	--
SVOC	132-64-9	Dibenzofuran	mg/kg	10	553	2%	0.0013	2.1	0.0023	0.099	20	1/10th ADEC - Direct Contact	--	--
SVOC	84-66-2	Diethyl phthalate	mg/kg	6	553	1%	0.0035	2.3	0.0039	0.11	6,190	1/10th ADEC - Direct Contact	--	--
SVOC	131-11-3	Dimethyl phthalate	mg/kg	4	553	1%	0.0018	2.7	0.032	0.23	77,300	1/10th ADEC - Direct Contact	--	--
SVOC	84-74-2	Di-n-butyl phthalate	mg/kg	45	553	8%	0.0026	3	0.0027	0.44	790	1/10th ADEC - Direct Contact	--	--
SVOC	117-84-0	Di-n-octyl phthalate	mg/kg	5	553	1%	0.0012	2.8	0.062	0.11	310	1/10th ADEC - Direct Contact	--	--
SVOC	118-74-1	Hexachlorobenzene	mg/kg	2	553	0%	0.0021	2	0.056	0.11	0.15	1/10th ADEC outdoor inhl	--	10
SVOC	77-47-4	Hexachlorocyclopentadiene	mg/kg	--	22	0%	0.025	0.41	--	--	0.2	1/10th ADEC outdoor inhl	--	5
SVOC	67-72-1	Hexachloroethane	mg/kg	--	553	0%	0.0022	5.3	--	--	6.5	1/10th ADEC - Direct Contact	--	--
SVOC	78-59-1	Isophorone	mg/kg	2	553	0%	0.0012	2	0.041	0.065	530	1/10th ADEC - Direct Contact	--	--
SVOC	*62-75-9*	*n-Nitrosodimethylamine*	*mg/kg*	*1*	*536*	*0%*	*0.0061*	*4.4*	*0.061*	*0.061*	*0.016*	*1/10th ADEC - Direct Contact*	*1*	*422*
SVOC	621-64-7	n-Nitrosodi-n-propylamine	mg/kg	4	553	1%	0.0021	2.1	0.04	0.28	0.052	1/10th ADEC - Direct Contact	3	61
SVOC	86-30-6	n-Nitrosodiphenylamine	mg/kg	2	553	0%	0.0014	2.8	0.056	0.1	75	1/10th ADEC - Direct Contact	--	--
SVOC	87-86-5	Pentachlorophenol	mg/kg	12	588	2%	0.0016	36	0.009	0.33	3.9	1/10th ADEC - Direct Contact	--	5
SVOC	108-95-2	Phenol	mg/kg	6	544	1%	0.0017	2.2	0.0065	0.071	2,320	1/10th ADEC - Direct Contact	--	--
PESTICIDES	72-54-8	4,4'-DDD	mg/kg	279	564	49%	0.000095	0.00683	0.00012	0.24	3	1/10th ADEC - Direct Contact	--	--
PESTICIDES	72-55-9	4,4'-DDE	mg/kg	325	564	58%	0.000042	0.0054	0.00011	0.38	2.1	1/10th ADEC - Direct Contact	--	--
PESTICIDES	50-29-3	4,4'-DDT	mg/kg	369	566	65%	0.000071	0.14	0.00011	2.2	2.1	1/10th ADEC - Direct Contact	2	--
PESTICIDES	309-00-2	Aldrin	mg/kg	--	556	0%	0.000031	0.023	--	--	0.03	1/10th ADEC - Direct Contact	--	--
PESTICIDES	319-84-6	alpha-BHC	mg/kg	5	560	1%	0.000106	0.024	0.00033	0.0013	0.12	1/10th ADEC - Direct Contact	--	--
PESTICIDES	319-85-7	beta-BHC	mg/kg	2	566	0%	0.00012	0.036	0.00085	0.037	0.4	1/10th ADEC - Direct Contact	--	--
PESTICIDES	57-74-9	Chlordane	mg/kg	--	18	0%	0.00213	0.00213	--	--	1.9	1/10th ADEC - Direct Contact	--	--
PESTICIDES	60-57-1	Dieldrin	mg/kg	5	564	1%	0.000041	0.035	0.0017	0.0057	0.032	1/10th ADEC - Direct Contact	--	1

TABLE 5-2

Comparison of Summarized Analytical Data to PSLs - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequenc y of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
PESTICIDES	72-20-8	Endrin	mg/kg	2	564	0%	0.000094	0.17	0.001	0.0018	0.2	1/10th ADEC - Direct Contact	--	--
PESTICIDES	58-89-9	gamma-BHC (Lindane)	mg/kg	14	557	3%	0.00008	0.019	0.0001	0.054	0.56	1/10th ADEC - Direct Contact	--	--
PESTICIDES	12789-03-6	gamma-Chlordane	mg/kg	30	564	5%	0.000048	0.036	0.000076	0.0037	1.6	Res RSL	--	--
PESTICIDES	76-44-8	Heptachlor	mg/kg	7	564	1%	0.00008	0.021	0.0003	0.015	0.13	1/10th ADEC - Direct Contact	--	--
PESTICIDES	1024-57-3	Heptachlor epoxide	mg/kg	5	566	1%	0.000056	0.013	0.00031	0.001	0.063	1/10th ADEC - Direct Contact	--	--
PESTICIDES	72-43-5	Methoxychlor	mg/kg	10	562	2%	0.000091	0.14	0.00029	0.0082	32	1/10th ADEC - Direct Contact	--	--
PESTICIDES	8001-35-2	Toxaphene	mg/kg	1	568	0%	0.0048	2.2	0.027	0.027	0.75	1/10th ADEC - Direct Contact	--	6
PCBs	12674-11-2	PCB-1016 (Aroclor 1016)	mg/kg	--	498	0%	0.0013	1.8	--	--	1	Site specific	--	1
PCBs	11104-28-2	PCB-1221 (Aroclor 1221)	mg/kg	--	498	0%	0.0013	2.2	--	--	1	Site specific	--	1
PCBs	11141-16-5	PCB-1232 (Aroclor 1232)	mg/kg	--	498	0%	0.0013	1.8	--	--	1	Site specific	--	1
PCBs	53469-21-9	PCB-1242 (Aroclor 1242)	mg/kg	--	498	0%	0.000902	1.8	--	--	1	Site specific	--	1
PCBs	12672-29-6	PCB-1248 (Aroclor 1248)	mg/kg	--	498	0%	0.0013	1.8	--	--	1	Site specific	--	1
PCBs	11097-69-1	PCB-1254 (Aroclor 1254)	mg/kg	--	498	0%	0.000879	1.8	--	--	1	Site specific	--	1
PCBs	11096-82-5	PCB-1260 (Aroclor 1260)	mg/kg	137	498	28%	0.00127	0.097	0.0034	0.9	1	Site specific	--	--
PAH	91-57-6	2-Methylnaphthalene	mg/kg	211	610	35%	0.00027	6.2	0.0003	0.21	28	1/10th ADEC - Direct Contact	--	--
PAH	83-32-9	Acenaphthene	mg/kg	59	610	10%	0.00016	2.2	0.00016	0.55	280	1/10th ADEC - Direct Contact	--	--
PAH	208-96-8	Acenaphthylene	mg/kg	27	610	4%	0.00022	2	0.00026	0.23	280	1/10th ADEC - Direct Contact	--	--
PAH	120-12-7	Anthracene	mg/kg	89	610	15%	0.00022	3.1	0.00023	0.11	2,060	1/10th ADEC - Direct Contact	--	--
PAH	56-55-3	Benzo(a)anthracene	mg/kg	140	610	23%	0.00016	2	0.00031	0.19	0.49	1/10th ADEC - Direct Contact	--	5
PAH	50-32-8	Benzo(a)pyrene	mg/kg	145	610	24%	0.00022	2.3	0.00023	0.17	0.049	1/10th ADEC - Direct Contact	3	15
PAH	205-99-2	Benzo(b)fluoranthene	mg/kg	155	610	25%	0.00048	2.9	0.00049	0.18	0.49	1/10th ADEC - Direct Contact	--	7
PAH	191-24-2	Benzo(g,h,i)perylene	mg/kg	143	610	23%	0.00023	2.5	0.00024	0.1	140	1/10th ADEC - Direct Contact	--	--
PAH	207-08-9	Benzo(k)fluoranthene	mg/kg	136	610	22%	0.00029	1.6	0.00035	0.13	4.9	1/10th ADEC - Direct Contact	--	--
PAH	218-01-9	Chrysene	mg/kg	179	610	29%	0.00033	9.7	0.00038	0.2	49	1/10th ADEC - Direct Contact	--	--
PAH	53-70-3	Dibenzo(a,h)anthracene	mg/kg	87	610	14%	0.00018	2	0.00021	0.099	0.049	1/10th ADEC - Direct Contact	2	15
PAH	206-44-0	Fluoranthene	mg/kg	198	611	32%	0.00028	3.5	0.00033	0.29	190	1/10th ADEC - Direct Contact	--	--
PAH	86-73-7	Fluorene	mg/kg	76	610	12%	0.00019	1.7	0.00019	0.58	230	1/10th ADEC - Direct Contact	--	--
PAH	193-39-5	Indeno(1,2,3-cd)pyrene	mg/kg	136	610	22%	0.00024	2.7	0.00024	0.13	0.49	1/10th ADEC - Direct Contact	--	5
PAH	91-20-3	Naphthalene	mg/kg	219	662	33%	0.0002	1.6	0.00033	0.54	2.8	1/10th ADEC outdoor inhl	--	--
PAH	85-01-8	Phenanthrene	mg/kg	260	611	43%	0.00033	1.8	0.00033	0.21	2,060	1/10th ADEC - Direct Contact	--	--
PAH	129-00-0	Pyrene	mg/kg	186	611	30%	0.00034	2.4	0.00039	0.28	140	1/10th ADEC - Direct Contact	--	--
OTHER - TIC	75-68-3	1-chloro-1,1-difluoroethane	mg/kg	1	1	100%	--	--	0.0132	0.0132	5,800	1/10 Res RSL	--	--
OTHER - TIC	75-37-6	Ethane, 1,1-difluoro-	mg/kg	1	1	100%	--	--	0.018	0.018	5,200	1/10 Res RSL	--	--
OTHER - TIC	109-66-0	Pentane	mg/kg	4	4	100%	--	--	0.0064	0.036	87	1/10 Res RSL	--	--
OTHER - TIC	115-07-1	Propene	mg/kg	4	4	100%	--	--	0.0055	0.0087	430,000,000	1/10 Res RSL	--	--
METALS	7429-90-5	Aluminum	mg/kg	557	557	100%	--	--	2,510	664,000	7,700	1/10 Res RSL	308	--
METALS	7440-36-0	Antimony	mg/kg	237	560	42%	0.01	0.27	0.0471	2.1	4.1	1/10th ADEC - Direct Contact	--	--
METALS	7440-38-2	Arsenic	mg/kg	589	590	100%	0.2	0.2	0.58	37.1	8.46	FT WW Background	168	--
METALS	7440-39-3	Barium	mg/kg	590	590	100%	--	--	11.4	393	2,030	1/10th ADEC - Direct Contact	--	--
METALS	7440-41-7	Beryllium	mg/kg	559	559	100%	--	--	0.027	0.361	20	1/10th ADEC - Direct Contact	--	--
METALS	7440-42-8	Boron	mg/kg	187	552	34%	0.297	7.63	0.527	12	1,600	1/10 Res RSL	--	--
METALS	7440-43-9	Cadmium	mg/kg	524	590	89%	0.05	0.068	0.048	5.2	7.9	1/10th ADEC - Direct Contact	--	--
METALS	7440-47-3	Chromium	mg/kg	590	590	100%	--	--	2.1	93.9	30	1/10th ADEC - Direct Contact	9	--
METALS	7440-48-4	Cobalt	mg/kg	559	559	100%	--	--	0.97	18.3	2.3	1/10 Res RSL	557	--
METALS	7440-50-8	Copper	mg/kg	559	559	100%	--	--	2.3	36,300	410	1/10th ADEC - Direct Contact	1	--
METALS	7439-89-6	Iron	mg/kg	557	557	100%	--	--	4,720	37,500	5,500	1/10 Res RSL	556	--
METALS	7439-92-1	Lead	mg/kg	593	593	100%	--	--	0.75	289	40	1/10th ADEC - Direct Contact	9	--
METALS	7439-96-5	Manganese	mg/kg	559	559	100%	--	--	40	4,360	180	1/10 Res RSL	436	--
METALS	7439-97-6	Mercury	mg/kg	429	582	74%	0.0001	0.015	0.007	0.17	1.8	1/10th ADEC outdoor inhl	--	--
METALS	7439-98-7	Molybdenum	mg/kg	98	98	100%	--	--	0.12	5.6	39	1/10 Res RSL	--	--
METALS	7440-02-0	Nickel	mg/kg	559	559	100%	--	--	2.5	74.3	200	1/10th ADEC - Direct Contact	--	--
METALS	7782-49-2	Selenium	mg/kg	436	589	74%	0.1	0.9	0.11	2.87	51	1/10th ADEC - Direct Contact	--	--
METALS	7440-22-4	Silver	mg/kg	456	591	77%	0.01	0.147	0.01	5.46	51	1/10th ADEC - Direct Contact	--	--
METALS	7440-24-6	Strontium	mg/kg	91	91	100%	--	--	7.1	43.3	4,700	1/10 Res RSL	--	--
METALS	7440-28-0	Thallium	mg/kg	238	559	43%	0.001	0.079	0.0133	0.147	0.81	1/10th ADEC - Direct Contact	--	--
METALS	7440-62-2	Vanadium	mg/kg	559	559	100%	--	--	3.8	58	71	1/10th ADEC - Direct Contact	--	--
METALS	7440-66-6	Zinc	mg/kg	559	559	100%	--	--	5	261	3,040	1/10th ADEC - Direct Contact	--	--

TABLE 5-2

Comparison of Summarized Analytical Data to PSLs - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	CAS Number	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
HERBICIDES	93-76-5	2,4,5-T	mg/kg	1	368	0%	0.00051	0.25	0.55	0.55	61	1/10 Res RSL	--	--
HERBICIDES	93-72-1	2,4,5-TP (Silvex)	mg/kg	--	368	0%	0.0019	0.11	--	--	52	1/10th ADEC - Direct Contact	--	--
HERBICIDES	94-75-7	2,4-D	mg/kg	--	368	0%	0.00071	0.041	--	--	86	1/10th ADEC - Direct Contact	--	--
HERBICIDES	94-82-6	2,4-DB	mg/kg	--	368	0%	0.0014	0.084	--	--	49	1/10 Res RSL	--	--
HERBICIDES	75-99-0	Dalapon	mg/kg	1	368	0%	0.0042	0.73	0.17	0.17	180	1/10 Res RSL	--	--
HERBICIDES	1918-00-9	Dicamba	mg/kg	2	368	1%	0.00083	0.048	0.0028	0.0086	180	1/10 Res RSL	--	--
HERBICIDES	88-85-7	Dinoseb	mg/kg	--	367	0%	0.0021	0.12	--	--	6.1	1/10 Res RSL	--	--
HERBICIDES	94-74-6	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	368	0%	0.00078	3.3	--	--	3.1	1/10 Res RSL	--	1
HERBICIDES	93-65-2	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	329	0%	0.00092	2.6	--	--	6.1	1/10 Res RSL	--	--
GEN CHEM	16984-48-8	Fluoride	mg/kg	5	7	71%	0.29	0.32	1.6	4.2	310	1/10 Res RSL	--	--
EXPLOSIVES	99-35-4	1,3,5-Trinitrobenzene	mg/kg	10	485	2%	0.0089	0.02	0.021	0.065	280	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	99-65-0	1,3-Dinitrobenzene	mg/kg	--	484	0%	0.027	0.05	--	--	0.71	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	118-96-7	2,4,6-Trinitrotoluene	mg/kg	--	484	0%	0.012	0.02	--	--	4.4	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	121-14-2	2,4-Dinitrotoluene	mg/kg	2	601	0%	0.0028	1.1	0.049	0.1	0.88	1/10th ADEC - Direct Contact	--	2
EXPLOSIVES	606-20-2	2,6-Dinitrotoluene	mg/kg	2	600	0%	0.0028	1.6	0.055	0.1	0.89	1/10th ADEC - Direct Contact	--	2
EXPLOSIVES	35572-78-2	2-Amino-4,6-dinitrotoluene	mg/kg	--	484	0%	0.026	0.1	--	--	2	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	88-72-2	2-Nitrotoluene	mg/kg	--	484	0%	0.028	0.08	--	--	2.6	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	99-08-1	3-Nitrotoluene	mg/kg	1	484	0%	0.0088	0.07	0.075	0.075	150	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	19406-51-0	4-Amino-2,6-dinitrotoluene	mg/kg	--	484	0%	0.015	0.02	--	--	1.9	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	99-99-0	4-Nitrotoluene	mg/kg	--	484	0%	0.016	0.08	--	--	35	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	--	484	0%	0.036	0.04	--	--	7.2	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	479-45-8	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	484	0%	0.01	0.05	--	--	40	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	98-95-3	Nitrobenzene	mg/kg	2	601	0%	0.002	4.1	0.049	0.072	5.1	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	55-63-0	Nitroglycerin	mg/kg	--	69	0%	0.13	0.13	--	--	30	1/10th ADEC - Direct Contact	--	--
EXPLOSIVES	2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	484	0%	0.028	0.03	--	--	460	1/10th ADEC - Direct Contact	--	--

Notes:

mg/kg = milligrams per kilogram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry
OTHER - TIC = Chemical detected in tentatively-identified compounds scan

Shaded = detected result exceeds screening criteria.
Italics = analyte with more than 50% non-detects with elevated MDLs

TABLE 5-3

Comparison of Summarized Analytical Data to PSLs - Groundwater

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 PSL	PSL Source	Number of Detects > Groundwater	Number of Nondetects > Groundwater
VOC	1,1,1,2-Tetrachloroethane	µg/L	--	228	0%	0.073	1	--	--	0.52	RSL	--	1
VOC	1,1,1-Trichloroethane	µg/L	--	228	0%	0.11	1.9	--	--	20	1/10th ADEC CUL	--	--
VOC	1,1,2,2-Tetrachloroethane	µg/L	26	228	11%	0.008	0.37	0.011	9.8	0.43	1/10th ADEC CUL	8	--
VOC	1,1,2-Trichloroethane	µg/L	4	228	2%	0.076	3.1	0.45	0.89	0.5	1/10th ADEC CUL	2	1
VOC	1,1-Dichloroethane	µg/L	--	228	0%	0.1	1	--	--	730	1/10th ADEC CUL	--	--
VOC	1,1-Dichloroethene	µg/L	15	228	7%	0.098	1.4	0.15	3.8	0.7	1/10th ADEC CUL	5	1
VOC	1,2,3-Trichlorobenzene	µg/L	1	228	0%	0.089	1.4	0.36	0.36	2.9	1/10th RSL	--	--
VOC	*1,2,3-Trichloropropane*	*µg/L*	*21*	*228*	*9%*	*0.014*	*0.31*	*0.016*	*1.2*	*0.012*	*1/10th ADEC CUL*	*21*	*207*
VOC	1,2,4-Trichlorobenzene	µg/L	1	231	0%	0.046	3.28	0.23	0.23	7	1/10th ADEC CUL	--	--
VOC	1,2,4-Trimethylbenzene	µg/L	7	228	3%	0.086	1.2	0.12	6.3	180	1/10th ADEC CUL	--	--
VOC	*1,2-Dibromo-3-chloropropane*	*µg/L*	--	*228*	*0%*	*0.32*	*3.2*	--	--	*0.00032*	*RSL*	--	*228*
VOC	*1,2-Dibromoethane*	*µg/L*	--	*228*	*0%*	*0.076*	*2.2*	--	--	*0.005*	*1/10th ADEC CUL*	--	*228*
VOC	1,2-Dichlorobenzene	µg/L	--	231	0%	0.07	3.28	--	--	60	1/10th ADEC CUL	--	--
VOC	1,2-Dichloroethane	µg/L	3	228	1%	0.15	2.2	0.11	0.37	0.5	1/10th ADEC CUL	--	1
VOC	1,2-Dichloropropane	µg/L	--	228	0%	0.092	1.5	--	--	0.5	1/10th ADEC CUL	--	1
VOC	1,3,5-Trimethylbenzene	µg/L	10	228	4%	0.077	1.4	0.19	6.1	180	1/10th ADEC CUL	--	--
VOC	1,3-Dichlorobenzene	µg/L	1	231	0%	0.04	3.28	0.042	0.042	330	1/10th ADEC CUL	--	--
VOC	1,3-Dichloropropane	µg/L	--	228	0%	0.07	0.7	--	--	73	1/10th RSL	--	--
VOC	1,4-Dichlorobenzene	µg/L	--	231	0%	0.052	3.28	--	--	7.5	1/10th ADEC CUL	--	--
VOC	2-Butanone	µg/L	8	228	4%	0.35	3.1	0.43	32	2,200	1/10th ADEC CUL	--	--
VOC	2-Chlorotoluene	µg/L	--	228	0%	0.06	0.7	--	--	73	1/10th RSL	--	--
VOC	2-Hexanone	µg/L	4	228	2%	0.17	3.1	0.18	1.1	4.7	1/10th RSL	--	--
VOC	4-Chlorotoluene	µg/L	--	228	0%	0.098	1	--	--	260	1/10th RSL	--	--
VOC	4-Methyl-2-pentanone	µg/L	--	228	0%	0.43	10	--	--	290	1/10th ADEC CUL	--	--
VOC	Acetone	µg/L	24	228	11%	1	3.1	1	30	3,300	1/10th ADEC CUL	--	--
VOC	Benzene	µg/L	5	228	2%	0.1	1.3	0.12	2.6	0.5	1/10th ADEC CUL	1	1
VOC	Bromobenzene	µg/L	--	228	0%	0.079	1.8	--	--	8.8	1/10th RSL	--	--
VOC	Bromodichloromethane	µg/L	--	228	0%	0.076	1.4	--	--	1.4	1/10th ADEC CUL	--	--
VOC	Bromoform	µg/L	--	228	0%	0.076	1	--	--	11	1/10th ADEC CUL	--	--
VOC	Bromomethane	µg/L	--	228	0%	0.08	2.9	--	--	5.1	1/10th ADEC CUL	--	--
VOC	Carbon Disulfide	µg/L	1	228	0%	0.066	1.6	0.09	0.09	370	1/10th ADEC CUL	--	--
VOC	Carbon tetrachloride	µg/L	--	228	0%	0.07	1.5	--	--	0.5	1/10th ADEC CUL	--	1
VOC	Chlorobenzene	µg/L	--	228	0%	0.063	1.2	--	--	10	1/10th ADEC CUL	--	--
VOC	Chloroethane	µg/L	5	228	2%	0.19	3.4	0.38	1.2	29	1/10th ADEC CUL	--	--
VOC	Chloroform	µg/L	2	228	1%	0.067	1.2	0.16	0.64	14	1/10th ADEC CUL	--	--
VOC	Chloromethane	µg/L	14	228	6%	0.18	2.5	0.28	1.5	6.6	1/10th ADEC CUL	--	--
VOC	cis-1,2-Dichloroethene	µg/L	26	228	11%	0.079	1	0.097	8.32	7	1/10th ADEC CUL	2	--
VOC	Dibromochloromethane	µg/L	--	228	0%	0.11	1.3	--	--	1	1/10th ADEC CUL	--	1
VOC	Dibromomethane	µg/L	--	228	0%	0.13	2.1	--	--	37	1/10th ADEC CUL	--	--
VOC	Dichlorodifluoromethane	µg/L	5	228	2%	0.13	1.6	0.37	4.7	730	1/10th ADEC CUL	--	--
VOC	Ethylbenzene	µg/L	18	228	8%	0.085	1	0.091	5.6	70	1/10th ADEC CUL	--	--
VOC	Hexachlorobutadiene	µg/L	--	231	0%	0.14	3.28	--	--	0.72	1/10th ADEC CUL	--	17
VOC	Isopropylbenzene	µg/L	3	228	1%	0.084	1.2	0.19	0.93	370	1/10th ADEC CUL	--	--
VOC	m,p-Xylene	µg/L	28	228	12%	0.17	1.8	0.18	23	120	1/10th RSL	--	--
VOC	Methylene chloride	µg/L	--	228	0%	0.09	3.5	--	--	0.5	1/10th ADEC CUL	--	94
VOC	Methyl-tert-butyl ether (MTBE)	µg/L	--	228	0%	0.14	1.9	--	--	47	1/10th ADEC CUL	--	--
VOC	n-Butylbenzene	µg/L	1	228	0%	0.098	1.2	0.89	0.89	37	1/10th ADEC CUL	--	--
VOC	n-Propylbenzene	µg/L	3	228	1%	0.069	1.5	0.095	1.2	37	1/10th ADEC CUL	--	--
VOC	sec-Butylbenzene	µg/L	4	228	2%	0.04	1.2	0.13	0.83	37	1/10th ADEC CUL	--	--

TABLE 5-3

Comparison of Summarized Analytical Data to PSLs - Groundwater

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 PSL	PSL Source	Number of Detects > Groundwater	Number of Nondetects > Groundwater
VOC	Styrene	µg/L	--	228	0%	0.061	1.5	--	--	10	1/10th ADEC CUL	--	--
VOC	tert-Butylbenzene	µg/L	7	228	3%	0.048	1.4	0.14	0.63	37	1/10th ADEC CUL	--	--
VOC	Tetrachloroethene (PCE)	µg/L	5	228	2%	0.088	1	0.13	1	0.5	1/10th ADEC CUL	1	1
VOC	Toluene	µg/L	22	228	10%	0.066	2.5	0.28	41	100	1/10th ADEC CUL	--	--
VOC	trans-1,2-Dichloroethene	µg/L	19	228	8%	0.074	1.1	0.1	8.1	10	1/10th ADEC CUL	--	--
VOC	Trichloroethene (TCE)	µg/L	68	228	30%	0.014	0.31	0.015	14	0.5	1/10th ADEC CUL	29	--
VOC	Trichlorofluoromethane	µg/L	--	228	0%	0.088	2.3	--	--	1,100	1/10th ADEC CUL	--	--
VOC	Vinyl chloride	µg/L	57	228	25%	0.0097	0.31	0.011	0.84	0.2	1/10th ADEC CUL	5	10
VOC	Xylenes, Total	µg/L	--	93	0%	1	1	--	--	1,000	1/10th ADEC CUL	--	--
TPH	DRO	µg/L	141	222	64%	16	281	17	29,000	150	1/10th ADEC CUL	38	66
TPH	GRO	µg/L	22	202	11%	10	100	11	200	220	1/10th ADEC CUL	--	--
TPH	RRO	µg/L	51	202	25%	84	4,200	33	1,490	110	1/10th ADEC CUL	24	71
SVOC	2,4,5-Trichlorophenol	µg/L	--	198	0%	1.9	67.4	--	--	370	1/10th ADEC CUL	--	--
SVOC	2,4,6-Trichlorophenol	µg/L	--	198	0%	1.9	67.4	--	--	7.7	1/10th ADEC CUL	--	2
SVOC	2,4-Dichlorophenol	µg/L	--	198	0%	2.5	67.4	--	--	11	1/10th ADEC CUL	--	2
SVOC	2,4-Dimethylphenol	µg/L	--	198	0%	2.1	67.4	--	--	73	1/10th ADEC CUL	--	--
SVOC	2,4-Dinitrophenol	µg/L	--	195	0%	13.9	326	--	--	7.3	1/10th ADEC CUL	--	195
SVOC	2-Chloronaphthalene	µg/L	--	201	0%	0.45	67.4	--	--	290	1/10th ADEC CUL	--	--
SVOC	2-Chlorophenol	µg/L	--	198	0%	0.42	67.4	--	--	18	1/10th ADEC CUL	--	1
SVOC	2-Methyl-4,6-dinitrophenol	µg/L	--	195	0%	2.1	326	--	--	0.37	1/10th RSL	--	195
SVOC	2-Methylphenol (o-Cresol)	µg/L	--	198	0%	0.88	67.4	--	--	180	1/10th ADEC CUL	--	--
SVOC	2-Nitroaniline	µg/L	--	201	0%	1.9	67.4	--	--	37	1/10th RSL	--	1
SVOC	3&4-Methylphenol	µg/L	--	198	0%	5.74	135	--	--	18	1/10th ADEC CUL for p-cresol	--	2
SVOC	3,3'-Dichlorobenzidine	µg/L	--	201	0%	0.91	67.4	--	--	0.19	1/10th ADEC CUL	--	201
SVOC	4-Chloro-3-methylphenol	µg/L	--	198	0%	1.9	67.4	--	--	370	1/10th RSL	--	--
SVOC	4-Chloroaniline	µg/L	--	181	0%	1.9	67.4	--	--	1.6	1/10th ADEC CUL	--	181
SVOC	Azobenzene	µg/L	--	66	0%	2.87	67.4	--	--	0.12	RSL	--	66
SVOC	Benzoic acid	µg/L	--	198	0%	19	543	--	--	15,000	1/10th ADEC CUL	--	--
SVOC	Benzyl alcohol	µg/L	--	201	0%	2.5	67.4	--	--	370	1/10th RSL	--	--
SVOC	Benzyl butyl phthalate	µg/L	--	201	0%	0.8	67.4	--	--	730	1/10th ADEC CUL	--	--
SVOC	bis-(2-Chloroethoxy)methane	µg/L	--	201	0%	0.95	67.4	--	--	11	1/10th RSL	--	1
SVOC	bis-(2-Chloroethyl)ether	µg/L	--	201	0%	0.86	67.4	--	--	0.077	1/10th ADEC CUL	--	201
SVOC	bis(2-Chloroisopropyl)ether	µg/L	--	201	0%	0.57	67.4	--	--	0.32	RSL	--	201
SVOC	bis-(2-Ethylhexyl)phthalate	µg/L	6	201	3%	0.95	67.4	2.4	2.7	0.6	1/10th ADEC CUL	6	195
SVOC	Carbazole	µg/L	--	201	0%	1.1	67.4	--	--	4.3	1/10th ADEC CUL	--	2
SVOC	Dibenzofuran	µg/L	--	201	0%	0.38	67.4	--	--	7.3	1/10th ADEC CUL	--	1
SVOC	Diethyl phthalate	µg/L	--	201	0%	0.53	67.4	--	--	2,900	1/10th ADEC CUL	--	--
SVOC	Dimethyl phthalate	µg/L	--	201	0%	0.45	67.4	--	--	37,000	1/10th ADEC CUL	--	--
SVOC	Di-n-butyl phthalate	µg/L	9	201	4%	0.62	67.4	1.2	1.9	370	1/10th ADEC CUL	--	--
SVOC	Di-n-octyl phthalate	µg/L	--	201	0%	0.67	67.4	--	--	150	1/10th ADEC CUL	--	--
SVOC	Hexachlorobenzene	µg/L	--	201	0%	0.53	67.4	--	--	0.1	1/10th ADEC CUL	--	201
SVOC	Hexachloroethane	µg/L	--	201	0%	0.58	67.4	--	--	4	1/10th ADEC CUL	--	2
SVOC	Isophorone	µg/L	--	201	0%	0.95	67.4	--	--	90	1/10th ADEC CUL	--	--
SVOC	n-Nitrosodimethylamine	µg/L	--	201	0%	0.91	67.4	--	--	0.0017	1/10th ADEC CUL	--	201
SVOC	n-Nitrosodi-n-propylamine	µg/L	--	201	0%	0.7	67.4	--	--	0.012	1/10th ADEC CUL	--	201
SVOC	n-Nitrosodiphenylamine	µg/L	--	201	0%	0.51	67.4	--	--	17	1/10th ADEC CUL	--	1
SVOC	Pentachlorophenol	µg/L	--	201	0%	0.018	326	--	--	0.1	1/10th ADEC CUL	--	76
SVOC	Phenol	µg/L	--	198	0%	0.46	67.4	--	--	1,100	1/10th ADEC CUL	--	--
PESTICIDES	4,4'-DDD	µg/L	1	202	0%	0.0038	0.87	0.0053	0.0053	0.35	1/10th ADEC CUL	--	1

TABLE 5-3

Comparison of Summarized Analytical Data to PSLs - Groundwater

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 PSL	PSL Source	Number of Detects > Groundwater	Number of Nondetects > Groundwater
PESTICIDES	4,4'-DDE	µg/L	3	202	1%	0.0057	1.3	0.012	0.07	0.25	1/10th ADEC CUL	--	2
PESTICIDES	4,4'-DDT	µg/L	19	202	9%	0.0048	1.1	0.0053	0.1	0.25	1/10th ADEC CUL	--	1
PESTICIDES	Aldrin	µg/L	1	202	0%	0.002	0.46	0.0025	0.0025	0.005	1/10th ADEC CUL	--	76
PESTICIDES	alpha-BHC	µg/L	--	202	0%	0.0055	1.3	--	--	0.014	1/10th ADEC CUL	--	9
PESTICIDES	beta-BHC	µg/L	--	202	0%	0.0044	1	--	--	0.047	1/10th ADEC CUL	--	5
PESTICIDES	Dieldrin	µg/L	1	202	0%	0.0048	1.1	0.063	0.063	0.0053	1/10th ADEC CUL	1	105
PESTICIDES	Endrin	µg/L	--	202	0%	0.0051	1.2	--	--	0.2	1/10th ADEC CUL	--	2
PESTICIDES	gamma-BHC (Lindane)	µg/L	1	202	0%	0.0047	1.1	0.03	0.03	0.02	1/10th ADEC CUL	1	9
PESTICIDES	gamma-Chlordane	µg/L	3	202	1%	0.0026	0.61	0.0055	0.01	0.19	RSL	--	1
PESTICIDES	Heptachlor	µg/L	7	202	3%	0.003	0.7	0.0051	0.3	0.04	1/10th ADEC CUL	3	3
PESTICIDES	Heptachlor epoxide	µg/L	--	202	0%	0.002	0.46	--	--	0.02	1/10th ADEC CUL	--	5
PESTICIDES	Methoxychlor	µg/L	--	202	0%	0.0087	5.9	--	--	4	1/10th ADEC CUL	--	1
PESTICIDES	Toxaphene	µg/L	--	202	0%	0.287	110	--	--	0.3	1/10th ADEC CUL	--	200
PCBs	PCB-1016 (Aroclor 1016)	µg/L	--	29	0%	0.024	0.31	--	--	0.96	RSL	--	--
PCBs	PCB-1221 (Aroclor 1221)	µg/L	--	29	0%	0.032	0.41	--	--	0.0068	RSL	--	29
PCBs	PCB-1232 (Aroclor 1232)	µg/L	--	29	0%	0.012	0.15	--	--	0.0068	RSL	--	29
PCBs	PCB-1242 (Aroclor 1242)	µg/L	--	29	0%	0.018	0.23	--	--	0.034	RSL	--	19
PCBs	PCB-1248 (Aroclor 1248)	µg/L	--	29	0%	0.01	0.13	--	--	0.034	RSL	--	19
PCBs	PCB-1254 (Aroclor 1254)	µg/L	--	29	0%	0.029	0.36	--	--	0.034	RSL	--	19
PCBs	PCB-1260 (Aroclor 1260)	µg/L	--	29	0%	0.022	0.28	--	--	0.034	RSL	--	19
PAH	2-Methylnaphthalene	µg/L	33	207	16%	0.0026	3.32	0.0031	12	15	1/10th ADEC CUL	--	--
PAH	Acenaphthene	µg/L	16	207	8%	0.003	3.32	0.0033	0.7	220	1/10th ADEC CUL	--	--
PAH	Acenaphthylene	µg/L	7	207	3%	0.0029	3.32	0.0034	0.13	220	1/10th ADEC CUL	--	--
PAH	Anthracene	µg/L	12	207	6%	0.0042	3.32	0.0074	0.57	1,100	1/10th ADEC CUL	--	--
PAH	Benzo(a)anthracene	µg/L	3	207	1%	0.0044	3.32	0.027	0.049	0.12	1/10th ADEC CUL	--	16
PAH	Benzo(a)pyrene	µg/L	3	207	1%	0.0042	3.32	0.02	0.0385	0.02	1/10th ADEC CUL	2	22
PAH	Benzo(b)fluoranthene	µg/L	3	207	1%	0.012	3.32	0.028	0.05	0.12	1/10th ADEC CUL	--	18
PAH	Benzo(g,h,i)perylene	µg/L	3	207	1%	0.0052	3.32	0.027	0.0375	110	1/10th ADEC CUL	--	--
PAH	Benzo(k)fluoranthene	µg/L	3	207	1%	0.0074	3.32	0.03	0.042	1.2	1/10th ADEC CUL	--	1
PAH	Chrysene	µg/L	3	207	1%	0.0038	3.32	0.029	0.043	12	1/10th ADEC CUL	--	--
PAH	Dibenzo(a,h)anthracene	µg/L	3	207	1%	0.014	3.32	0.028	0.0787	0.012	1/10th ADEC CUL	3	204
PAH	Fluoranthene	µg/L	5	207	2%	0.0041	3.32	0.0091	0.04	150	1/10th ADEC CUL	--	--
PAH	Fluorene	µg/L	23	207	11%	0.0038	3.32	0.0042	1.5	150	1/10th ADEC CUL	--	--
PAH	Indeno(1,2,3-cd)pyrene	µg/L	3	207	1%	0.013	3.7	0.028	0.038	0.12	1/10th ADEC CUL	--	21
PAH	Naphthalene	µg/L	56	231	24%	0.0012	1.5	0.0013	8.8	73	1/10th ADEC CUL	--	--
PAH	Phenanthrene	µg/L	13	207	6%	0.006	3.32	0.01	1.1	1,100	1/10th ADEC CUL	--	--
PAH	Pyrene	µg/L	5	207	2%	0.004	3.32	0.0084	0.039	110	1/10th ADEC CUL	--	--
OTHER - TIC	1-chloro-1,1-difluoroethane	µg/L	8	9	89%	30	30	6.7	36	10,000	1/10th RSL	--	--
METALS	Aluminum	µg/L	53	202	26%	35	150	35.1	6,400	7,538	EAFB background (total)	--	--
METALS	Antimony	µg/L	14	202	7%	0.31	2	0.321	3.8	0.6	1/10th ADEC CUL	10	121
METALS	Arsenic	µg/L	142	202	70%	1	1.5	0.95	36.4	36.24	Ft WW background (total)	1	--
METALS	Barium	µg/L	202	202	100%	--	--	35.1	441	551.22	Ft WW background (total)	--	--
METALS	Beryllium	µg/L	--	202	0%	0.1	0.8	--	--	0.4	1/10th ADEC CUL	--	77
METALS	Boron	µg/L	48	202	24%	10	62	16.4	200	730	1/10th RSL	--	--
METALS	Cadmium	µg/L	2	202	1%	0.16	0.6	0.25	0.33	5.38	Ft WW background (total)	--	--
METALS	Chromium	µg/L	5	202	2%	0.55	6.2	1.1	18	53	Ft WW background (total)	--	--
METALS	Cobalt	µg/L	152	202	75%	0.31	1	0.311	23.4	1.1	1/10th RSL	114	--
METALS	Copper	µg/L	78	202	39%	0.55	3.1	0.64	38	100	1/10th ADEC CUL	--	--
METALS	Iron	µg/L	179	202	89%	16	310	17	38,700	16,938	EAFB background (total)	11	--

TABLE 5-3

Comparison of Summarized Analytical Data to PSLs - Groundwater

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 PSL	PSL Source	Number of Detects > Groundwater	Number of Nondetects > Groundwater
METALS	Lead	µg/L	12	202	6%	0.22	0.6	0.329	18	34.07	Ft WW background (total)	--	--
METALS	Manganese	µg/L	201	202	100%	3.1	3.1	4.8	3,530	3,875	EAFB background (total)	--	--
METALS	Mercury	µg/L	--	202	0%	0.055	0.11	--	--	0.2	1/10th ADEC CUL	--	--
METALS	Nickel	µg/L	170	202	84%	0.62	1	0.644	98.6	10	1/10th ADEC CUL	22	--
METALS	Selenium	µg/L	62	202	31%	0.62	1	0.639	25.2	5	1/10th ADEC CUL	11	--
METALS	Silver	µg/L	1	202	0%	0.08	0.62	0.088	0.088	10	1/10th ADEC CUL	--	--
METALS	Thallium	µg/L	2	202	1%	0.36	0.78	0.58	0.6	0.2	1/10th ADEC CUL	2	200
METALS	Vanadium	µg/L	19	202	9%	4	6.2	0.64	23	24	1/10th ADEC CUL	--	--
METALS	Zinc	µg/L	51	202	25%	2.4	7.8	3.2	66	500	1/10th ADEC CUL	--	--
HERBICIDES	2,4,5-T	µg/L	--	201	0%	0.014	0.31	--	--	37	1/10th RSL	--	--
HERBICIDES	2,4,5-TP (Silvex)	µg/L	--	201	0%	0.02	0.29	--	--	5	1/10th ADEC CUL	--	--
HERBICIDES	2,4-D	µg/L	--	201	0%	0.011	0.52	--	--	7	1/10th ADEC CUL	--	--
HERBICIDES	2,4-DB	µg/L	1	201	0%	0.02	3.2	1.6	1.6	29	1/10th RSL	--	--
HERBICIDES	Dalapon	µg/L	--	201	0%	0.041	0.5	--	--	110	1/10th RSL	--	--
HERBICIDES	Dicamba	µg/L	1	201	0%	0.021	0.53	0.079	0.079	110	1/10th RSL	--	--
HERBICIDES	Dinoseb	µg/L	1	201	0%	0.033	1.3	0.26	0.26	3.7	1/10th RSL	--	--
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	µg/L	--	167	1%	0.013	250	67	250	3.7	1/10th RSL	--	67
EXPLOSIVES	1,3,5-Trinitrobenzene	µg/L	8	171	5%	0.016	0.02	0.031	0.36	110	1/10th ADEC CUL	--	--
EXPLOSIVES	1,3-Dinitrobenzene	µg/L	--	171	0%	0.017	0.022	--	--	0.37	1/10th ADEC CUL	--	--
EXPLOSIVES	2,4,6-Trinitrotoluene	µg/L	1	171	1%	0.01	0.013	0.097	0.097	1.8	1/10th ADEC CUL	--	--
EXPLOSIVES	2,4-Dinitrotoluene	µg/L	--	202	0%	0.019	3.44	--	--	0.13	1/10th ADEC CUL	--	35
EXPLOSIVES	2,6-Dinitrotoluene	µg/L	--	202	0%	0.015	3.44	--	--	0.13	1/10th ADEC CUL	--	35
EXPLOSIVES	2-Amino-4,6-dinitrotoluene	µg/L	1	171	1%	0.026	0.032	0.035	0.035	0.73	1/10th ADEC CUL	--	--
EXPLOSIVES	2-Nitrotoluene	µg/L	--	171	0%	0.017	0.021	--	--	0.37	1/10th ADEC CUL	--	--
EXPLOSIVES	3-Nitrotoluene	µg/L	--	171	0%	0.023	0.029	--	--	73	1/10th ADEC CUL	--	--
EXPLOSIVES	4-Amino-2,6-dinitrotoluene	µg/L	2	171	1%	0.016	0.02	0.016	0.026	0.73	1/10th ADEC CUL	--	--
EXPLOSIVES	4-Nitrotoluene	µg/L	--	171	0%	0.023	0.029	--	--	5	1/10th ADEC CUL	--	--
EXPLOSIVES	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	µg/L	13	171	8%	0.02	0.025	0.061	2.6	0.77	1/10th ADEC CUL	3	--
EXPLOSIVES	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	µg/L	--	171	0%	0.018	0.022	--	--	15	1/10th ADEC CUL	--	--
EXPLOSIVES	Nitrobenzene	µg/L	3	202	1%	0.013	3.44	0.016	0.065	1.8	1/10th ADEC CUL	--	8
EXPLOSIVES	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	µg/L	6	171	4%	0.047	0.059	0.059	0.46	180	1/10th ADEC CUL	--	--

Notes:

µg/L = micrograms per liter

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry
OTHER - TIC = Chemical detected in tentatively-identified compounds scan

Shaded = detected result exceeds screening criteria.
Italics = analyte with more than 50% non-detects with elevated MDLs

TABLE 5-4

Comparison of Summarized Analytical Data to PSLs - Soil Gas

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (Possible COIs are Highlighted in Green)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2010 Soil Gas PSL	PSL Source	Number of Detects > PSL	Number of Nondetects > PSL
VOC	1,1,1-Trichloroethane	µg/m3	171	220	78%	5.4	90	0.031	62	2,290	1/10th ADEC Shallow SG Target Level	--	--
VOC	1,1,2,2-Tetrachloroethane	µg/m3	3	219	1%	0.022	110	0.063	0.25	0.42	1/10th ADEC Shallow SG Target Level	--	49
VOC	1,1,2-Trichloroethane	µg/m3	15	219	7%	0.027	90	0.056	0.34	1.5	1/10th ADEC Shallow SG Target Level	--	49
VOC	1,1-Dichloroethane	µg/m3	48	219	22%	0.01	66	0.011	2.4	520	1/10th ADEC Shallow SG Target Level	--	--
VOC	1,1-Dichloroethene	µg/m3	167	220	76%	0.023	66	0.028	200	0.49	1/10th ADEC Shallow SG Target Level	66	31
VOC	1,2,3-Trichloropropane	µg/m3	1	218	0%	0.24	100	1	1	0.012	1/10th ADEC Shallow SG Target Level	1	217
VOC	1,2,4-Trichlorobenzene	µg/m3	4	218	2%	0.2	300	1.3	7.5	4.2	1/10th ADEC Shallow SG Target Level	1	49
VOC	1,2,4-Trimethylbenzene	µg/m3	48	219	22%	0.065	110	0.073	160	7.3	1/10th ADEC Shallow SG Target Level	2	12
VOC	1,2-Dibromoethane	µg/m3	--	218	0%	0.18	130	--	--	0.041	1/10th ADEC Shallow SG Target Level	--	218
VOC	1,2-Dichlorobenzene	µg/m3	7	218	3%	0.068	90	0.093	1.1	210	1/10th ADEC Shallow SG Target Level	--	--
VOC	1,2-Dichloroethane	µg/m3	31	219	14%	0.0058	66	0.015	1.1	0.94	1/10th ADEC Shallow SG Target Level	1	49
VOC	1,2-Dichloropropane	µg/m3	4	218	2%	0.17	110	0.56	8.8	1.3	1/10th ADEC Shallow SG Target Level	2	49
VOC	1,3,5-Trimethylbenzene	µg/m3	15	218	7%	0.076	90	0.12	56	7.3	1/10th ADEC Shallow SG Target Level	1	12
VOC	1,3-Dichlorobenzene	µg/m3	7	218	3%	0.088	80	0.12	0.9	210	1/10th ADEC Shallow SG Target Level	--	--
VOC	1,4-Dichlorobenzene	µg/m3	14	218	6%	0.12	300	0.12	1.6	3.5	1/10th ADEC Shallow SG Target Level	--	49
VOC	2-Butanone	µg/m3	153	220	70%	0.24	98	0.27	52	5,210	1/10th ADEC Shallow SG Target Level	--	--
VOC	4-Methyl-2-pentanone	µg/m3	16	218	7%	0.11	140	0.13	4.5	3,130	1/10th ADEC Shallow SG Target Level	--	--
VOC	Acetone	µg/m3	147	220	67%	0.32	98	1.7	96	3,290	1/10th ADEC Shallow SG Target Level	--	--
VOC	Benzene	µg/m3	101	220	46%	0.016	80	0.051	1.1	3.1	1/10th ADEC Shallow SG Target Level	--	49
VOC	Bromodichloromethane	µg/m3	1	218	0%	0.074	110	0.86	0.86	1.4	1/10th ADEC Shallow SG Target Level	--	49
VOC	Bromoform	µg/m3	1	218	0%	0.16	86	0.75	0.75	22	1/10th ADEC Shallow SG Target Level	--	4
VOC	Bromomethane	µg/m3	70	218	32%	0.19	130	0.23	34	5.2	1/10th ADEC Shallow SG Target Level	7	42
VOC	Carbon Disulfide	µg/m3	143	220	65%	0.1	100	0.12	230	730	1/10th ADEC Shallow SG Target Level	--	--
VOC	Carbon tetrachloride	µg/m3	171	220	78%	6.3	100	0.026	38	1.6	1/10th ADEC Shallow SG Target Level	4	49
VOC	Chlorobenzene	µg/m3	7	218	3%	0.085	76	0.1	0.18	52	1/10th ADEC Shallow SG Target Level	--	1
VOC	Chloroethane	µg/m3	3	218	1%	0.11	66	0.34	0.47	29	1/10th ADEC Shallow SG Target Level	--	1
VOC	Chloroform	µg/m3	184	220	84%	4.9	81	0.068	280	1.1	1/10th ADEC Shallow SG Target Level	171	36
VOC	Chloromethane	µg/m3	--	49	0%	2.1	35	--	--	14	1/10th ADEC Shallow SG Target Level	--	1
VOC	cis-1,2-Dichloroethene	µg/m3	42	219	19%	0.025	53	0.029	32	37	1/10th ADEC Shallow SG Target Level	--	1
VOC	Dibromochloromethane	µg/m3	1	218	0%	0.14	140	0.27	0.27	1	1/10th ADEC Shallow SG Target Level	--	49
VOC	Dibromomethane	µg/m3	--	49	0%	11	180	--	--	37	1/10th ADEC Shallow SG Target Level	--	6
VOC	Dichlorodifluoromethane	µg/m3	3	49	6%	4.9	81	5.1	14	210	1/10th ADEC Shallow SG Target Level	--	--
VOC	Ethylbenzene	µg/m3	138	220	63%	0.012	71	0.013	130	22	1/10th ADEC Shallow SG Target Level	2	1
VOC	Hexachlorobutadiene	µg/m3	4	219	2%	0.076	230	0.25	2.3	1.11	1/10th ADEC Shallow SG Target Level	1	49
VOC	Isopropylbenzene	µg/m3	8	218	4%	0.07	81	0.11	6.1	420	1/10th ADEC Shallow SG Target Level	--	--
VOC	Methylene chloride	µg/m3	21	218	10%	0.18	47	0.22	16	52	1/10th ADEC Shallow SG Target Level	--	--
VOC	Methyl-tert-butyl ether (MTBE)	µg/m3	2	218	1%	0.12	60	0.25	0.34	47	1/10th ADEC Shallow SG Target Level	--	1
VOC	n-Butylbenzene	µg/m3	--	49	0%	3.3	55	--	--	37	1/10th ADEC Shallow SG Target Level	--	1
VOC	n-Propylbenzene	µg/m3	13	218	6%	0.079	81	0.1	17	37	1/10th ADEC Shallow SG Target Level	--	1
VOC	sec-Butylbenzene	µg/m3	--	49	0%	5.5	91	--	--	37	1/10th ADEC Shallow SG Target Level	--	1
VOC	Styrene	µg/m3	11	218	5%	0.1	70	0.12	0.24	1,040	1/10th ADEC Shallow SG Target Level	--	--
VOC	tert-Butylbenzene	µg/m3	--	49	0%	5.5	91	--	--	37	1/10th ADEC Shallow SG Target Level	--	1
VOC	Tetrachloroethene (PCE)	µg/m3	172	220	78%	6.8	110	0.13	110	4.1	1/10th ADEC Shallow SG Target Level	23	48
VOC	Toluene	µg/m3	167	220	76%	0.0062	63	0.053	68	5,210	1/10th ADEC Shallow SG Target Level	--	--
VOC	trans-1,2-Dichloroethene	µg/m3	13	219	6%	0.015	66	0.024	0.83	63	1/10th ADEC Shallow SG Target Level	--	1
VOC	Trichloroethene (TCE)	µg/m3	117	220	53%	0.014	90	0.016	110	0.22	1/10th ADEC Shallow SG Target Level	43	48
VOC	Trichlorofluoromethane	µg/m3	173	220	79%	5.6	93	2	30	730	1/10th ADEC Shallow SG Target Level	--	--
VOC	Vinyl chloride	µg/m3	69	219	32%	0.0078	63	0.019	0.15	0.81	1/10th ADEC Shallow SG Target Level	--	49
VOC	Xylenes, Total	µg/m3	3	49	6%	4.3	71	11	600	100	1/10th ADEC Shallow SG Target Level	2	--
VOC/PAH	Naphthalene	µg/m3	13	219	6%	0.078	270	0.098	12	0.72	1/10th ADEC Shallow SG Target Level	11	105

Notes:

Shaded = detected result exceeds screening criteria.

µg/m3 = micrograms per cubic meter of air

VOC = volatile organic compounds

TABLE 5-5

Comparison of Summarized 95UCL-Adjusted Sound Berm MI Sample Results to 2007 Soil Screening Levels

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

										Comparison to Screening Level		
Chemical Group	Analyte (Highlighting indicates exceedance of 2007 Screening Level)	Unit	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2007 Soil SL	Number of Detects > SL	Number of Nondetects > SL
VOC	1,1,1,2-Tetrachloroethane	mg/kg	--	9	0%	0.0031	0.0061	--	--	3	--	--
VOC	1,1,1-Trichloroethane	mg/kg	--	9	0%	0.0034	0.0067	--	--	1385	--	--
VOC	1,1,2,2-Tetrachloroethane	mg/kg	--	9	0%	0.0030	0.0059	--	--	0.38	--	--
VOC	1,1,2-Trichloroethane	mg/kg	--	9	0%	0.0029	0.0057	--	--	0.84	--	--
VOC	1,1-Dichloroethane	mg/kg	--	9	0%	0.0030	0.0058	--	--	85	--	--
VOC	1,1-Dichloroethene	mg/kg	--	9	0%	0.0045	0.0089	--	--	28	--	--
VOC	1,1-Dichloropropene	mg/kg	--	9	0%	0.0023	0.0044	--	--	--	--	--
VOC	1,2,3-Trichlorobenzene	mg/kg	--	9	0%	0.0033	0.0064	--	--	--	--	--
VOC	1,2,3-Trichloropropane	mg/kg	--	9	0%	0.026	0.052	--	--	0.32	--	--
VOC	1,2,4-Trichlorobenzene	mg/kg	--	9	0%	0.0038	0.030	--	--	14	--	--
VOC	1,2,4-Trimethylbenzene	mg/kg	--	9	0%	0.0018	0.0036	--	--	5.7	--	--
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	9	0%	0.026	0.052	--	--	0.0026	--	9
VOC	1,2-Dibromoethane	mg/kg	--	9	0%	0.0028	0.0056	--	--	0.028	--	--
VOC	1,2-Dichlorobenzene	mg/kg	--	9	0%	0.0021	0.047	--	--	28	--	--
VOC	1,2-Dichloroethane	mg/kg	--	9	0%	0.0025	0.0049	--	--	0.35	--	--
VOC	1,2-Dichloropropane	mg/kg	--	9	0%	0.0025	0.0049	--	--	0.35	--	--
VOC	1,3,5-Trimethylbenzene	mg/kg	--	9	0%	0.0018	0.0036	--	--	2.1	--	--
VOC	1,3-Dichlorobenzene	mg/kg	--	9	0%	0.0017	0.043	--	--	6.9	--	--
VOC	1,3-Dichloropropane	mg/kg	--	9	0%	0.0024	0.0046	--	--	11	--	--
VOC	1,4-Dichlorobenzene	mg/kg	--	9	0%	0.0019	0.049	--	--	3.2	--	--
VOC	2,2-Dichloropropane	mg/kg	--	9	0%	0.0023	0.0044	--	--	--	--	--
VOC	2-Butanone	mg/kg	1	9	11%	0.014	0.027	0.065	0.065	3209	--	--
VOC	2-Chlorotoluene	mg/kg	--	9	0%	0.0019	0.0037	--	--	16	--	--
VOC	2-Hexanone	mg/kg	--	9	0%	0.0036	0.0070	--	--	--	--	--
VOC	4-Chlorotoluene	mg/kg	--	9	0%	0.0015	0.0029	--	--	--	--	--
VOC	4-Isopropyltoluene	mg/kg	1	9	9%	0.0022	0.0043	0.13	0.13	--	--	--
VOC	4-Methyl-2-pentanone	mg/kg	--	9	0%	0.0065	0.013	--	--	580	--	--
VOC	Acetone	mg/kg	5	9	56%	0.054	0.10	0.22	0.28	1415	--	--
VOC	Benzene	mg/kg	4	9	44%	0.0020	0.0034	0.0039	0.0058	0.66	--	--
VOC	Bromobenzene	mg/kg	--	9	0%	0.0049	0.0096	--	--	7.3	--	--
VOC	Bromochloromethane	mg/kg	--	9	0%	0.0038	0.0075	--	--	--	--	--
VOC	Bromodichloromethane	mg/kg	--	9	0%	0.0026	0.0052	--	--	1	--	--
VOC	Bromoform	mg/kg	--	9	0%	0.0058	0.011	--	--	62	--	--
VOC	Bromomethane	mg/kg	--	9	0%	0.011	0.022	--	--	0.87	--	--
VOC	Carbon disulfide	mg/kg	--	9	0%	0.0058	0.011	--	--	721	--	--
VOC	Carbon tetrachloride	mg/kg	--	9	0%	0.0031	0.0061	--	--	0.24	--	--
VOC	Chlorobenzene	mg/kg	--	9	0%	0.0023	0.0045	--	--	27	--	--
VOC	Chloroethane	mg/kg	--	9	0%	0.0079	0.015	--	--	3	--	--
VOC	Chloroform	mg/kg	--	9	0%	0.0014	0.0027	--	--	0.25	--	--
VOC	Chloromethane	mg/kg	1	9	9%	0.0058	0.011	0.0076	0.0076	11	--	--
VOC	cis-1,2-Dichloroethene	mg/kg	--	9	0%	0.0043	0.0085	--	--	4.3	--	--
VOC	cis-1,3-Dichloropropene	mg/kg	--	9	0%	0.0022	0.0042	--	--	0.7	--	--

TABLE 5-5
Comparison of Summarized 95UCL-Adjusted Sound Berm MI Sample Results to 2007 Soil Screening Levels
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Chemical Group	Analyte (Highlighting indicates exceedance of 2007 Screening Level)	Unit	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	Comparison to Screening Level: 2007 Soil SL	Comparison to Screening Level: Number of Detects > SL	Comparison to Screening Level: Number of Nondetects > SL
VOC	Dibromochloromethane	mg/kg	--	9	0%	0.0033	0.0065	--	--	1	--	--
VOC	Dibromomethane	mg/kg	--	9	0%	0.0034	0.0067	--	--	14	--	--
VOC	Dichlorodifluoromethane	mg/kg	--	9	0%	0.0050	0.0097	--	--	9.4	--	--
VOC	Ethylbenzene	mg/kg	1	9	11%	0.0035	0.0067	0.0068	0.0068	234	--	--
VOC	Hexachlorobutadiene	mg/kg	--	9	0%	0.0058	0.037	--	--	6.2	--	--
VOC	Isopropylbenzene	mg/kg	--	9	0%	9.00E-04	0.0018	--	--	37	--	--
VOC	m,p-Xylene	mg/kg	2	9	18%	0.0027	0.0052	0.0028	0.0063	214	--	--
VOC	Methylene chloride	mg/kg	--	9	0%	0.0028	0.0056	--	--	8.9	--	--
VOC	Methyl-tert-butyl ether (MTBE)	mg/kg	--	9	0%	0.0019	0.0037	--	--	32	--	--
VOC	n-Butylbenzene	mg/kg	--	9	0%	0.0026	0.0051	--	--	14	--	--
VOC	n-Propylbenzene	mg/kg	--	9	0%	0.0025	0.0049	--	--	14	--	--
VOC	o-Xylene	mg/kg	--	9	0%	0.0027	0.0054	--	--	282	--	--
VOC	sec-Butylbenzene	mg/kg	--	9	0%	0.0013	0.0025	--	--	11	--	--
VOC	Styrene	mg/kg	--	9	0%	0.0016	0.0032	--	--	1734	--	--
VOC	tert-Butylbenzene	mg/kg	--	9	0%	0.0022	0.0042	--	--	13	--	--
VOC	Tetrachloroethene (PCE)	mg/kg	--	9	0%	0.0022	0.0043	--	--	0.55	--	--
VOC	Toluene	mg/kg	5	9	56%	0.0024	0.0030	0.022	0.039	521	--	--
VOC	trans-1,2-Dichloroethene	mg/kg	--	9	0%	0.0033	0.0064	--	--	12	--	--
VOC	trans-1,3-Dichloropropene	mg/kg	--	9	0%	0.0024	0.0046	--	--	0.7	--	--
VOC	Trichloroethene (TCE)	mg/kg	--	9	0%	0.0029	0.0057	--	--	0.043	--	--
VOC	Trichlorofluoromethane	mg/kg	--	9	0%	0.0026	0.0051	--	--	39	--	--
VOC	Vinyl chloride	mg/kg	--	9	0%	0.0037	0.0073	--	--	0.043	--	--
TPH	TPH-Diesel (DRO)	mg/kg	9	9	100%	--	--	6.3	11	1025	--	--
TPH	TPH-Gasoline (GRO)	mg/kg	--	9	0%	1.3	1.9	--	--	140	--	--
TPH	TPH-Motor Oil (RRO)	mg/kg	9	9	100%	--	--	34	70	1000	--	--
SVOC	2,4,5-Trichlorophenol	mg/kg	--	9	0%	0.034	0.040	--	--	611	--	--
SVOC	2,4,6-Trichlorophenol	mg/kg	--	9	0%	0.050	0.059	--	--	44	--	--
SVOC	2,4-Dichlorophenol	mg/kg	--	9	0%	0.020	0.023	--	--	18	--	--
SVOC	2,4-Dimethylphenol	mg/kg	--	9	0%	0.16	0.19	--	--	122	--	--
SVOC	2,4-Dinitrophenol	mg/kg	--	9	0%	0.63	0.73	--	--	12	--	--
SVOC	2-Chloronaphthalene	mg/kg	--	9	0%	0.018	0.021	--	--	386	--	--
SVOC	2-Chlorophenol	mg/kg	--	9	0%	0.021	0.024	--	--	6.4	--	--
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	9	0%	0.63	0.73	--	--	--	--	--
SVOC	2-Methylphenol (o-Cresol)	mg/kg	--	9	0%	0.055	0.064	--	--	31	--	--
SVOC	2-Nitroaniline	mg/kg	--	9	0%	0.043	0.050	--	--	18	--	--
SVOC	2-Nitrophenol	mg/kg	--	9	0%	0.028	0.033	--	--	--	--	--
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	9	0%	0.31	0.37	--	--	1.1	--	--
SVOC	3-Nitroaniline	mg/kg	--	9	0%	0.16	0.19	--	--	--	--	--
SVOC	4-Bromophenyl phenyl ether	mg/kg	--	9	0%	0.022	0.026	--	--	--	--	--
SVOC	4-Chloro-3-methylphenol	mg/kg	--	9	0%	0.013	0.016	--	--	--	--	--
SVOC	4-Chloroaniline	mg/kg	--	9	0%	0.055	0.064	--	--	24	--	--
SVOC	4-Chlorophenyl phenyl ether	mg/kg	--	9	0%	0.013	0.016	--	--	--	--	--

TABLE 5-5
Comparison of Summarized 95UCL-Adjusted Sound Berm MI Sample Results to 2007 Soil Screening Levels
Remedial Investigation Report
FWA 102 Former Communications Site, Fort Wainwright, Alaska

Chemical Group	Analyte (Highlighting indicates exceedance of 2007 Screening Level)	Unit	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	Comparison to Screening Level: 2007 Soil SL	Number of Detects > SL	Number of Nondetects > SL
SVOC	4-Nitroaniline	mg/kg	--	9	0%	0.035	0.041	--	--	--	--	--
SVOC	4-Nitrophenol	mg/kg	--	9	0%	5.60E-04	0.0012	--	--	49	--	--
SVOC	Benzoic acid	mg/kg	--	9	0%	0.16	0.19	--	--	100000	--	--
SVOC	Benzyl alcohol	mg/kg	--	9	0%	0.16	0.19	--	--	1833	--	--
SVOC	Benzyl butyl phthalate	mg/kg	--	9	0%	0.018	0.021	--	--	240	--	--
SVOC	bis-(2-Chloroethoxy)methane	mg/kg	--	9	0%	0.021	0.024	--	--	--	--	--
SVOC	bis-(2-Chloroethyl)ether	mg/kg	--	9	0%	0.030	0.036	--	--	0.21	--	--
SVOC	bis(2-Chloroisopropyl)ether	mg/kg	--	9	0%	0.030	0.036	--	--	2.9	--	--
SVOC	bis-(2-Ethylhexyl)phthalate	mg/kg	2	9	22%	0.023	0.027	0.068	0.071	35	--	--
SVOC	Carbazole	mg/kg	--	9	0%	0.052	0.061	--	--	24	--	--
SVOC	Dibenzofuran	mg/kg	--	9	0%	0.017	0.020	--	--	15	--	--
SVOC	Diethyl phthalate	mg/kg	--	9	0%	0.019	0.022	--	--	4888	--	--
SVOC	Dimethyl phthalate	mg/kg	--	9	0%	0.022	0.026	--	--	100000	--	--
SVOC	Di-n-butyl phthalate	mg/kg	--	9	0%	0.025	0.029	--	--	611	--	--
SVOC	Di-n-octyl phthalate	mg/kg	--	9	0%	0.023	0.027	--	--	200	--	--
SVOC	Hexachlorobenzene	mg/kg	--	9	0%	0.016	0.019	--	--	0.3	--	--
SVOC	Hexachloroethane	mg/kg	--	9	0%	0.044	0.051	--	--	35	--	--
SVOC	Isophorone	mg/kg	--	9	0%	0.016	0.019	--	--	512	--	--
SVOC	m,p-Cresol	mg/kg	--	9	0%	0.31	0.37	--	--	--	--	--
SVOC	n-Nitrosodimethylamine	mg/kg	--	9	0%	0.036	0.042	--	--	0.0023	--	9
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	9	0%	0.017	0.020	--	--	0.069	--	--
SVOC	n-Nitrosodiphenylamine	mg/kg	--	9	0%	0.023	0.027	--	--	99	--	--
SVOC	Pentachlorophenol	mg/kg	--	9	0%	8.90E-04	0.0020	--	--	3	--	--
SVOC	Phenol	mg/kg	--	9	0%	0.018	0.021	--	--	1833	--	--
PEST	4,4'-DDD	mg/kg	9	9	100%	--	--	0.010	0.059	2.4	--	--
PEST	4,4'-DDE	mg/kg	9	9	100%	--	--	0.014	0.060	1.7	--	--
PEST	4,4'-DDT	mg/kg	9	9	100%	--	--	0.25	0.66	1.7	--	--
PEST	Aldrin	mg/kg	--	9	0%	1.90E-04	0.011	--	--	0.029	--	--
PEST	alpha-BHC	mg/kg	--	9	0%	2.00E-04	0.012	--	--	0.09	--	--
PEST	alpha-Chlordane	mg/kg	2	9	18%	1.80E-04	0.011	9.40E-04	0.0030	1.6	--	--
PEST	beta-BHC	mg/kg	--	9	0%	3.00E-04	0.018	--	--	0.32	--	--
PEST	delta-BHC	mg/kg	--	9	0%	1.40E-04	0.0085	--	--	--	--	--
PEST	Dieldrin	mg/kg	2	9	22%	2.90E-04	0.0034	0.0078	0.019	0.03	--	--
PEST	Endosulfan I	mg/kg	--	9	0%	1.30E-04	0.0074	--	--	37	--	--
PEST	Endosulfan II	mg/kg	--	9	0%	5.90E-04	0.035	--	--	37	--	--
PEST	Endosulfan sulfate	mg/kg	--	9	0%	2.00E-04	0.012	--	--	--	--	--
PEST	Endrin	mg/kg	--	9	0%	2.20E-04	0.013	--	--	1.8	--	--
PEST	Endrin aldehyde	mg/kg	--	9	0%	2.40E-04	0.014	--	--	--	--	--
PEST	Endrin ketone	mg/kg	--	9	0%	3.10E-04	0.018	--	--	--	--	--
PEST	gamma-BHC (Lindane)	mg/kg	--	9	0%	1.50E-04	0.0090	--	--	0.44	--	--
PEST	gamma-Chlordane	mg/kg	2	9	18%	3.00E-04	0.018	8.90E-04	0.0027	--	--	--
PEST	Heptachlor	mg/kg	--	9	0%	1.70E-04	0.010	--	--	0.11	--	--

TABLE 5-5

Comparison of Summarized 95UCL-Adjusted Sound Berm MI Sample Results to 2007 Soil Screening Levels

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

										Comparison to Screening Level		
Chemical Group	**Analyte (Highlighting indicates exceedance of 2007 Screening Level)**	**Unit**	**Number of Detects**	**Number of Samples**	**Frequency of Detection**	**Minimum MDL**	**Maximum MDL**	**Minimum Detected Value**	**Maximum Detected Value**	**2007 Soil SL**	**Number of Detects > SL**	**Number of Nondetects > SL**
PEST	Heptachlor epoxide	mg/kg	4	9	36%	1.10E-04	0.0064	3.60E-04	9.50E-04	0.053	--	--
PEST	Methoxychlor	mg/kg	--	9	0%	0.0012	0.069	--	--	31	--	--
PEST	Toxaphene	mg/kg	--	9	0%	0.020	1.1	--	--	0.44	--	1
PCB	PCB-1016 (Aroclor 1016)	mg/kg	--	9	0%	0.0080	0.0088	--	--	1	--	--
PCB	PCB-1221 (Aroclor 1221)	mg/kg	--	9	0%	0.010	0.011	--	--	1	--	--
PCB	PCB-1232 (Aroclor 1232)	mg/kg	--	9	0%	0.0080	0.0088	--	--	1	--	--
PCB	PCB-1242 (Aroclor 1242)	mg/kg	--	9	0%	0.0080	0.0088	--	--	1	--	--
PCB	PCB-1248 (Aroclor 1248)	mg/kg	--	9	0%	0.0080	0.0088	--	--	1	--	--
PCB	PCB-1254 (Aroclor 1254)	mg/kg	--	9	0%	0.0080	0.0088	--	--	1	--	--
PCB	PCB-1260 (Aroclor 1260)	mg/kg	6	9	67%	0.0082	0.0088	0.036	0.087	1	--	--
PCB	PCB-1262 (Aroclor 1262)	mg/kg	--	9	0%	0.011	0.012	--	--	1	--	--
PCB	PCB-1268 (Aroclor 1268)	mg/kg	--	9	0%	0.011	0.012	--	--	1	--	--
PAH	2-Methylnaphthalene	mg/kg	--	9	0%	0.051	0.060	--	--	203	--	--
PAH	Acenaphthene	mg/kg	--	9	0%	0.018	0.021	--	--	368	--	--
PAH	Acenaphthylene	mg/kg	--	9	0%	0.016	0.019	--	--	610	--	--
PAH	Anthracene	mg/kg	--	9	0%	0.026	0.030	--	--	2190	--	--
PAH	Benzo(a)anthracene	mg/kg	2	9	18%	0.016	0.019	0.020	0.025	0.15	--	--
PAH	Benzo(a)pyrene	mg/kg	2	9	18%	0.019	0.022	0.029	0.030	0.015	2	7
PAH	Benzo(b)fluoranthene	mg/kg	--	9	0%	0.024	0.028	--	--	0.15	--	--
PAH	Benzo(g,h,i)perylene	mg/kg	1	9	9%	0.021	0.023	0.10	0.10	300	--	--
PAH	Benzo(k)fluoranthene	mg/kg	2	9	18%	0.013	0.016	0.018	0.027	1.5	--	--
PAH	Chrysene	mg/kg	--	9	0%	0.080	0.093	--	--	15	--	--
PAH	Dibenzo(a,h)anthracene	mg/kg	--	9	0%	0.016	0.019	--	--	0.015	--	9
PAH	Fluoranthene	mg/kg	1	9	9%	0.028	0.033	0.035	0.035	229	--	--
PAH	Fluorene	mg/kg	--	9	0%	0.014	0.017	--	--	264	--	--
PAH	Indeno(1,2,3-cd)pyrene	mg/kg	--	9	0%	0.022	0.026	--	--	0.15	--	--
PAH	Naphthalene	mg/kg	1	9	8%	0.0025	0.032	0.0071	0.0071	12	--	--
PAH	Phenanthrene	mg/kg	2	9	18%	0.015	0.017	0.025	0.035	3000	--	--
PAH	Pyrene	mg/kg	2	9	18%	0.020	0.023	0.037	0.039	231	--	--
HERB	2,4,5-T	mg/kg	--	9	0%	2.70E-04	6.00E-04	--	--	61	--	--
HERB	2,4,5-TP (Silvex)	mg/kg	--	9	0%	0.0010	0.0022	--	--	49	--	--
HERB	2,4-D	mg/kg	--	9	0%	3.80E-04	8.40E-04	--	--	69	--	--
HERB	2,4-DB	mg/kg	--	9	0%	7.90E-04	0.0017	--	--	49	--	--
HERB	Dalapon	mg/kg	--	9	0%	0.0023	0.0050	--	--	183	--	--
HERB	Dicamba	mg/kg	--	9	0%	4.50E-04	9.90E-04	--	--	183	--	--
HERB	Dichlorprop	mg/kg	--	9	0%	7.10E-04	0.0016	--	--	--	--	--
HERB	Dinoseb	mg/kg	--	9	0%	0.0011	0.0025	--	--	6.1	--	--
HERB	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	9	0%	4.20E-04	9.40E-04	--	--	3.1	--	--
HERB	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	9	0%	5.00E-04	0.0011	--	--	6.1	--	--
EXP	1,3,5-Trinitrobenzene	mg/kg	--	9	0%	0.0086	0.020	--	--	183	--	--
EXP	1,3-Dinitrobenzene	mg/kg	--	9	0%	0.022	0.050	--	--	0.61	--	--
EXP	2,4,6-Trinitrotoluene	mg/kg	--	9	0%	0.0086	0.020	--	--	16	--	--

TABLE 5-5

Comparison of Summarized 95UCL-Adjusted Sound Berm MI Sample Results to 2007 Soil Screening Levels

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

										Comparison to Screening Level		
Chemical Group	Analyte (Highlighting indicates exceedance of 2007 Screening Level)	Unit	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	2007 Soil SL	Number of Detects > SL	Number of Nondetects > SL
EXP	2,4-Dinitrotoluene	mg/kg	--	9	0%	0.014	0.023	--	--	12	--	--
EXP	2,6-Dinitrotoluene	mg/kg	--	9	0%	0.022	0.033	--	--	6.1	--	--
EXP	2-Amino-4,6-dinitrotoluene	mg/kg	--	9	0%	0.043	0.099	--	--	--	--	--
EXP	2-Nitrotoluene	mg/kg	--	9	0%	0.034	0.079	--	--	2.8	--	--
EXP	3-Nitrotoluene	mg/kg	--	9	0%	0.030	0.069	--	--	156	--	--
EXP	4-Amino-2,6-dinitrotoluene	mg/kg	--	9	0%	0.0086	0.020	--	--	--	--	--
EXP	4-Nitrotoluene	mg/kg	--	9	0%	0.034	0.079	--	--	40	--	--
EXP	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	--	9	0%	0.017	0.040	--	--	4.4	--	--
EXP	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	9	0%	0.022	0.050	--	--	24	--	--
EXP	Nitrobenzene	mg/kg	--	9	0%	0.036	0.084	--	--	2	--	--
EXP	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	9	0%	0.013	0.030	--	--	306	--	--

Highlighting indicates screening level exceedance.

--	no result	mg/kg	milligrams per kilogram	SL	screening Level
EXP	explosives	NV	no value	SVOC	semi-volatile organic compound
HERB	herbicides	PEST	pesticides	TPH	total petroleum hydrocarbons
MDL	method detection limit			VOC	volatile organic compound

TABLE 5-6

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
VOC	1,1,1,2-Tetrachloroethane	mg/kg	--	175	0%	0.000098	0.012	--	--	0.0002	--	156
VOC	1,1,1-Trichloroethane	mg/kg	18	175	10%	0.00015	0.0056	0.002	0.11	0.82	--	--
VOC	1,1,2,2-Tetrachloroethane	mg/kg	1	175	1%	0.000089	0.0091	0.017	0.017	0.017	--	--
VOC	1,1,2-Trichloroethane	mg/kg	--	175	0%	0.000088	0.0098	--	--	0.018	--	--
VOC	1,1-Dichloroethane	mg/kg	--	175	0%	0.000048	0.014	--	--	25	--	--
VOC	1,1-Dichloroethene	mg/kg	--	175	0%	0.00007	0.009	--	--	0.03	--	--
VOC	1,2,3-Trichlorobenzene	mg/kg	2	175	1%	0.00014	0.014	0.00078	0.013	0.087	--	--
VOC	1,2,3-Trichloropropane	mg/kg	--	175	0%	0.00027	0.26	--	--	0.00053	--	137
VOC	1,2,4-Trichlorobenzene	mg/kg	1	180	1%	0.00022	0.029	6.2	6.2	0.85	1	--
VOC	1,2,4-Trimethylbenzene	mg/kg	8	175	5%	0.000093	0.0099	0.00013	0.031	23	--	--
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	175	0%	0.00078	0.99	--	--	0.00000014	--	175
VOC	1,2-Dibromoethane	mg/kg	--	175	0%	0.00015	0.0095	--	--	0.00016	--	174
VOC	1,2-Dichlorobenzene	mg/kg	1	180	1%	0.000063	0.045	0.0002	0.0002	5.1	--	--
VOC	1,2-Dichloroethane	mg/kg	2	175	1%	0.000054	0.012	0.0091	0.045	0.016	1	--
VOC	1,2-Dichloropropane	mg/kg	--	175	0%	0.000065	0.014	--	--	0.018	--	--
VOC	1,3,5-Trimethylbenzene	mg/kg	4	175	2%	0.00004	0.0086	0.00012	0.022	23	--	--
VOC	1,3-Dichlorobenzene	mg/kg	1	180	1%	0.00007	0.042	0.00019	0.00019	28	--	--
VOC	1,3-Dichloropropane	mg/kg	--	175	0%	0.000059	0.0065	--	--	0.25	--	--
VOC	1,4-Dichlorobenzene	mg/kg	1	180	1%	0.0001	0.047	0.011	0.011	0.64	--	--
VOC	2-Butanone	mg/kg	35	175	20%	0.0016	0.35	0.0034	0.1	59	--	--
VOC	2-Chlorotoluene	mg/kg	--	175	0%	0.000051	0.0083	--	--	0.71	--	--
VOC	2-Hexanone	mg/kg	--	175	0%	0.00078	0.2	--	--	0.011	--	89
VOC	2-Methyl-1-propanol	mg/kg	1	1	100%	--	--	0.01	0.01	2.3	--	--
VOC	4-Chlorotoluene	mg/kg	--	175	0%	0.000092	0.0068	--	--	2.5	--	--
VOC	4-Methyl-2-pentanone	mg/kg	--	175	0%	0.00024	0.57	--	--	8.1	--	--
VOC	Acetone	mg/kg	52	175	30%	0.0014	0.28	0.014	0.51	88	--	--
VOC	Benzene	mg/kg	18	175	10%	0.00014	0.0069	0.0013	0.4	0.025	1	--
VOC	Bromobenzene	mg/kg	--	175	0%	0.000092	0.011	--	--	0.059	--	--
VOC	Bromodichloromethane	mg/kg	--	175	0%	0.000044	0.32	--	--	0.044	--	1
VOC	Bromoform	mg/kg	--	175	0%	0.00025	0.32	--	--	0.34	--	--
VOC	Bromomethane	mg/kg	12	175	7%	0.00042	0.04	0.0031	0.043	0.16	--	--
VOC	Carbon Disulfide	mg/kg	36	175	21%	0.000053	0.01	0.000099	0.0059	12	--	--
VOC	Carbon tetrachloride	mg/kg	--	175	0%	0.000078	0.013	--	--	0.023	--	--
VOC	Chlorobenzene	mg/kg	1	175	1%	0.000054	0.017	0.0001	0.0001	0.63	--	--
VOC	Chloroethane	mg/kg	--	175	0%	0.0003	0.042	--	--	580	--	--
VOC	Chloroform	mg/kg	8	175	5%	0.000048	0.015	0.00024	0.15	0.46	--	--
VOC	Chloromethane	mg/kg	6	175	3%	0.000057	0.011	0.0003	0.16	0.21	--	--
VOC	cis-1,2-Dichloroethene	mg/kg	2	175	1%	0.000081	0.0091	0.0004	0.014	0.24	--	--
VOC	Dibromochloromethane	mg/kg	--	175	0%	0.00016	0.28	--	--	0.032	--	1
VOC	Dibromomethane	mg/kg	--	175	0%	0.00012	0.022	--	--	1.1	--	--
VOC	Dichlorodifluoromethane	mg/kg	17	175	10%	0.000072	0.017	0.01	0.037	140	--	--
VOC	Ethylbenzene	mg/kg	6	175	3%	0.000041	0.01	0.00063	0.024	6.9	--	--
VOC	Hexachlorobutadiene	mg/kg	--	180	0%	0.00017	0.035	--	--	0.12	--	--
VOC	Isopropylbenzene	mg/kg	--	175	0%	0.000031	0.0087	--	--	51	--	--
VOC	m,p-Xylene	mg/kg	8	175	5%	0.000093	0.022	0.00018	2.8	1.2	1	--
VOC	Methylene chloride	mg/kg	22	175	13%	0.00014	0.019	0.0016	6.1	0.016	16	4
VOC	Methyl-tert-butyl ether (MTBE)	mg/kg	2	174	1%	0.00008	0.025	0.00024	0.019	1.3	--	--

TABLE 5-6

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
VOC	n-Butylbenzene	mg/kg	1	175	1%	0.000088	0.008	0.00016	0.00016	15	--	--
VOC	n-Propylbenzene	mg/kg	--	175	0%	0.000062	0.0099	--	--	15	--	--
VOC	o-Xylene	mg/kg	3	175	2%	0.000059	0.01	0.000076	0.0089	1.2	--	--
VOC	sec-Butylbenzene	mg/kg	--	175	0%	0.000065	0.008	--	--	12	--	--
VOC	Styrene	mg/kg	1	175	1%	0.000076	0.0075	0.00015	0.00015	0.96	--	--
VOC	tert-Butylbenzene	mg/kg	--	175	0%	0.000054	0.0053	--	--	12	--	--
VOC	Tetrachloroethene (PCE)	mg/kg	12	175	7%	0.00012	0.011	0.0057	0.088	0.024	4	--
VOC	Toluene	mg/kg	38	175	22%	0.000044	0.0074	0.0011	2.9	6.5	--	--
VOC	trans-1,2-Dichloroethene	mg/kg	--	175	0%	0.000048	0.48	--	--	0.37	--	1
VOC	Trichloroethene (TCE)	mg/kg	10	175	6%	0.00013	0.015	0.00029	0.081	0.02	6	--
VOC	Trichlorofluoromethane	mg/kg	8	175	5%	0.000054	0.013	0.00014	2.4	86	--	--
VOC	Vinyl Acetate	mg/kg	--	1	0%	0.029	0.029	--	--	100	--	--
VOC	Vinyl chloride	mg/kg	--	175	0%	0.000057	0.016	--	--	0.0085	--	88
VOC	Xylenes, Total	mg/kg	--	26	0%	0.0324	0.0519	--	--	63	--	--
TPH	DRO	mg/kg	134	199	67%	1.4	7.06	0.6	360	250	1	--
TPH	GRO	mg/kg	5	183	3%	0.772	5.3	0.61	850	11,000	--	--
TPH	RRO	mg/kg	159	199	80%	3	50	3.4	860	300	6	--
SVOC	1,2-Diphenylhydrazine	mg/kg	--	6	0%	0.015	0.015	--	--	0.00027	--	6
SVOC	2,4,5-Trichlorophenol	mg/kg	1	155	1%	0.003	0.0893	0.011	0.011	67	--	--
SVOC	2,4,6-Trichlorophenol	mg/kg	--	155	0%	0.0018	0.11	--	--	1.4	--	--
SVOC	2,4-Dichlorophenol	mg/kg	--	155	0%	0.0018	0.0893	--	--	1.3	--	--
SVOC	2,4-Dimethylphenol	mg/kg	--	140	0%	0.0055	0.35	--	--	8.8	--	--
SVOC	2,4-Dinitrophenol	mg/kg	--	155	0%	0.036	1.4	--	--	0.54	--	37
SVOC	2-Chloronaphthalene	mg/kg	--	178	0%	0.0036	0.0893	--	--	120	--	--
SVOC	2-Chlorophenol	mg/kg	--	155	0%	0.0017	0.0893	--	--	1.5	--	--
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	155	0%	0.0017	1.4	--	--	0.0062	--	44
SVOC	2-Methylphenol (o-Cresol)	mg/kg	--	155	0%	0.0034	0.12	--	--	15	--	--
SVOC	2-Nitroaniline	mg/kg	--	178	0%	0.0027	0.095	--	--	0.15	--	--
SVOC	3&4-Methylphenol	mg/kg	--	37	0%	0.051	0.7	--	--	1.5	--	--
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	171	0%	0.0037	0.7	--	--	0.19	--	11
SVOC	4-Chloro-3-methylphenol	mg/kg	--	154	0%	0.0021	0.0893	--	--	4.3	--	--
SVOC	4-Chloroaniline	mg/kg	--	178	0%	0.0021	0.12	--	--	0.057	--	37
SVOC	4-Methylphenol (p-Cresol)	mg/kg	2	118	2%	0.0029	0.017	0.0037	0.0084	1.5	--	--
SVOC	4-Nitroaniline	mg/kg	--	178	0%	0.0034	1.08	--	--	0.0014	--	178
SVOC	Azobenzene	mg/kg	--	164	0%	0.0024	0.0893	--	--	0.00096	--	164
SVOC	Benzoic acid	mg/kg	7	155	5%	0.096	0.859	0.11	0.859	410	--	--
SVOC	Benzyl alcohol	mg/kg	41	177	23%	0.0037	0.36	0.0037	0.2	0.89	--	--
SVOC	Benzyl butyl phthalate	mg/kg	10	178	6%	0.0015	0.0893	0.0023	0.055	920	--	--
SVOC	bis-(2-Chloroethoxy)methane	mg/kg	--	178	0%	0.0013	0.0893	--	--	0.025	--	29
SVOC	bis-(2-Chloroethyl)ether	mg/kg	--	178	0%	0.0024	0.0893	--	--	0.0022	--	178
SVOC	bis(2-Chloroisopropyl)ether	mg/kg	--	178	0%	0.0012	0.0893	--	--	0.00012	--	178
SVOC	bis-(2-Ethylhexyl)phthalate	mg/kg	49	179	27%	0.0017	0.0893	0.0037	0.52	13	--	--
SVOC	Carbazole	mg/kg	20	177	11%	0.0013	0.12	0.0014	0.037	6.5	--	--
SVOC	Dibenzofuran	mg/kg	5	178	3%	0.0013	0.0893	0.0014	0.011	11	--	--
SVOC	Diethyl phthalate	mg/kg	1	178	1%	0.0035	0.0893	0.36	0.36	130	--	--
SVOC	Dimethyl phthalate	mg/kg	--	179	0%	0.0018	0.0893	--	--	1,100	--	--
SVOC	Di-n-butyl phthalate	mg/kg	8	179	4%	0.0026	0.0893	0.0028	0.27	80	--	--

TABLE 5-6

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
SVOC	Di-n-octyl phthalate	mg/kg	--	178	0%	0.0012	0.0893	--	--	3,800	--	--
SVOC	Hexachlorobenzene	mg/kg	--	178	0%	0.0021	0.0893	--	--	0.047	--	26
SVOC	Hexachlorocyclopentadiene	mg/kg	--	1	0%	0.026	0.026	--	--	1.3	--	--
SVOC	Hexachloroethane	mg/kg	--	178	0%	0.0022	0.097	--	--	0.21	--	--
SVOC	Isophorone	mg/kg	--	178	0%	0.0016	0.0893	--	--	3.1	--	--
SVOC	n-Nitrosodimethylamine	mg/kg	--	177	0%	0.0061	0.0893	--	--	0.000053	--	177
SVOC	n-Nitrosodi-n-propylamine	mg/kg	--	178	0%	0.0032	0.0893	--	--	0.0011	--	178
SVOC	n-Nitrosodiphenylamine	mg/kg	--	178	0%	0.0022	0.0893	--	--	15	--	--
SVOC	Pentachlorophenol	mg/kg	3	155	2%	0.0019	0.71	0.028	0.089	0.047	2	35
SVOC	Phenol	mg/kg	4	155	3%	0.0019	0.0893	0.0032	0.052	68	--	--
PESTICIDES	4,4'-DDD	mg/kg	167	188	89%	0.00011	0.0068	0.00013	1.81	7.2	--	--
PESTICIDES	4,4'-DDE	mg/kg	183	188	97%	0.000667	0.00355	0.00011	0.33	5.1	--	--
PESTICIDES	4,4'-DDT	mg/kg	185	187	99%	0.00339	0.00355	0.00043	1.6	7.3	--	--
PESTICIDES	Aldrin	mg/kg	--	188	0%	0.00015	0.053	--	--	0.07	--	--
PESTICIDES	alpha-BHC	mg/kg	2	188	1%	0.00011	0.053	0.00098	0.0014	0.0064	--	2
PESTICIDES	beta-BHC	mg/kg	3	188	2%	0.00018	0.053	0.00036	0.00084	0.022	--	2
PESTICIDES	Dieldrin	mg/kg	8	188	4%	0.00014	0.0699	0.0002	0.0053	0.0076	--	2
PESTICIDES	Endrin	mg/kg	--	188	0%	0.000094	0.0699	--	--	0.29	--	--
PESTICIDES	gamma-BHC (Lindane)	mg/kg	4	188	2%	0.00008	0.053	0.00016	0.00077	0.0095	--	2
PESTICIDES	gamma-Chlordane	mg/kg	20	188	11%	0.000064	0.053	0.00012	0.012	0.013	--	2
PESTICIDES	Heptachlor	mg/kg	3	188	2%	0.00008	0.0699	0.000085	0.00055	0.28	--	--
PESTICIDES	Heptachlor epoxide	mg/kg	11	188	6%	0.000084	0.0699	0.00012	0.0016	0.014	--	2
PESTICIDES	Methoxychlor	mg/kg	21	188	11%	0.0001	0.0699	0.00013	0.0043	23	--	--
PESTICIDES	Toxaphene	mg/kg	--	188	0%	0.0048	1.69	--	--	3.9	--	--
PCBs	PCB-1016 (Aroclor 1016)	mg/kg	--	74	0%	0.0021	0.05	--	--	0.092	--	--
PCBs	PCB-1221 (Aroclor 1221)	mg/kg	--	74	0%	0.0021	0.063	--	--	0.00012	--	74
PCBs	PCB-1232 (Aroclor 1232)	mg/kg	--	74	0%	0.0021	0.05	--	--	0.00012	--	74
PCBs	PCB-1242 (Aroclor 1242)	mg/kg	--	74	0%	0.0021	0.059	--	--	0.0053	--	65
PCBs	PCB-1248 (Aroclor 1248)	mg/kg	--	74	0%	0.0021	0.05	--	--	0.0052	--	65
PCBs	PCB-1254 (Aroclor 1254)	mg/kg	--	74	0%	0.0021	0.14	--	--	0.0088	--	47
PCBs	PCB-1260 (Aroclor 1260)	mg/kg	37	74	50%	0.0021	0.038	0.0053	0.83	0.024	31	2
PAH	2-Methylnaphthalene	mg/kg	150	220	68%	0.00034	0.64	0.0003	0.028	6.1	--	--
PAH	Acenaphthene	mg/kg	42	220	19%	0.00016	0.9	0.00016	0.014	180	--	--
PAH	Acenaphthylene	mg/kg	11	220	5%	0.00022	0.48	0.00023	0.0024	180	--	--
PAH	Anthracene	mg/kg	61	220	28%	0.00022	0.59	0.00022	0.0616	3,000	--	--
PAH	Benzo(a)anthracene	mg/kg	153	220	70%	0.00016	0.63	0.0002	0.12	3.6	--	--
PAH	Benzo(a)pyrene	mg/kg	154	220	70%	0.00022	0.68	0.00024	0.091	2.1	--	--
PAH	Benzo(b)fluoranthene	mg/kg	161	220	73%	0.00048	1.8	0.00048	0.13	12	--	--
PAH	Benzo(g,h,i)perylene	mg/kg	125	220	57%	0.00023	0.58	0.00028	0.053	38,700	--	--
PAH	Benzo(k)fluoranthene	mg/kg	108	220	49%	0.0003	0.03	0.00034	0.047	120	--	--
PAH	Chrysene	mg/kg	167	220	76%	0.00035	0.86	0.00041	0.13	360	--	--
PAH	Dibenzo(a,h)anthracene	mg/kg	61	220	28%	0.00019	0.036	0.00026	0.019	4	--	--
PAH	Fluoranthene	mg/kg	173	220	79%	0.0003	0.27	0.00035	0.23	1,400	--	--
PAH	Fluorene	mg/kg	65	220	30%	0.00019	0.62	0.00019	0.11	220	--	--
PAH	Indeno(1,2,3-cd)pyrene	mg/kg	123	220	56%	0.00024	0.85	0.00032	0.073	41	--	--
PAH	Naphthalene	mg/kg	74	220	34%	0.00027	0.031	0.00035	0.19	20	--	--
PAH	Phenanthrene	mg/kg	185	220	84%	0.00033	0.65	0.00041	0.21	3,000	--	--

TABLE 5-6

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Surface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
PAH	Pyrene	mg/kg	175	220	80%	0.00036	0.44	0.0004	0.19	1,000	--	--
OTHER - TIC	Pentane	mg/kg	3	3	100%	--	--	0.0052	0.011	10	--	--
OTHER - TIC	Propanal	mg/kg	1	1	100%	--	--	0.016	0.016	0.0034	1	--
HERBICIDES	2,4,5-T	mg/kg	--	113	0%	0.00057	0.022	--	--	0.15	--	--
HERBICIDES	2,4,5-TP (Silvex)	mg/kg	--	113	0%	0.0021	0.05	--	--	0.19	--	--
HERBICIDES	2,4-D	mg/kg	10	113	9%	0.0008	0.035	0.0037	0.014	0.21	--	--
HERBICIDES	2,4-DB	mg/kg	--	113	0%	0.0016	0.065	--	--	0.12	--	--
HERBICIDES	Dalapon	mg/kg	--	113	0%	0.0047	0.72	--	--	0.23	--	28
HERBICIDES	Dicamba	mg/kg	--	113	0%	0.00094	0.019	--	--	0.28	--	--
HERBICIDES	Dinoseb	mg/kg	--	113	0%	0.0023	0.034	--	--	0.32	--	--
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	113	0%	0.00089	2.9	--	--	0.0047	--	105
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	16	0%	0.001	5.3	--	--	0.011	--	8
EXPLOSIVES	1,3,5-Trinitrobenzene	mg/kg	4	126	3%	0.009	0.0094	0.027	0.045	19	--	--
EXPLOSIVES	1,3-Dinitrobenzene	mg/kg	--	126	0%	0.027	0.055	--	--	0.02	--	126
EXPLOSIVES	2,4,6-Trinitrotoluene	mg/kg	--	126	0%	0.012	0.022	--	--	0.49	--	--
EXPLOSIVES	2,4-Dinitrotoluene	mg/kg	--	180	0%	0.0028	0.025	--	--	0.0093	--	57
EXPLOSIVES	2,6-Dinitrotoluene	mg/kg	--	180	0%	0.0028	0.033	--	--	0.0094	--	77
EXPLOSIVES	2-Amino-4,6-dinitrotoluene	mg/kg	--	126	0%	0.026	0.11	--	--	0.056	--	4
EXPLOSIVES	2-Nitrotoluene	mg/kg	--	126	0%	0.028	0.089	--	--	0.025	--	126
EXPLOSIVES	3-Nitrotoluene	mg/kg	--	126	0%	0.0089	0.078	--	--	4.9	--	--
EXPLOSIVES	4-Amino-2,6-dinitrotoluene	mg/kg	--	126	0%	0.015	0.022	--	--	0.056	--	--
EXPLOSIVES	4-Nitrotoluene	mg/kg	--	126	0%	0.016	0.089	--	--	0.34	--	--
EXPLOSIVES	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	--	126	0%	0.037	0.044	--	--	0.04	--	1
EXPLOSIVES	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	126	0%	0.011	0.056	--	--	4.5	--	--
EXPLOSIVES	Nitrobenzene	mg/kg	1	180	1%	0.002	0.083	0.049	0.049	0.094	--	--
EXPLOSIVES	Nitroglycerin	mg/kg	--	4	0%	0.13	0.14	--	--	0.22	--	--
EXPLOSIVES	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	126	0%	0.029	0.033	--	--	49	--	--

Notes:

mg/kg = milligrams per kilogram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry
OTHER - TIC = Chemical detected in tentatively-identified compounds scan

Shaded = detected result exceeds screening criteria.

TABLE 5-7

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
VOC	1,1,1,2-Tetrachloroethane	mg/kg	--	624	0%	0.000092	0.028	--	--	0.0002	--	592
VOC	1,1,1-Trichloroethane	mg/kg	47	624	8%	0.00015	0.03	0.00024	0.1	0.82	--	--
VOC	1,1,2,2-Tetrachloroethane	mg/kg	5	624	1%	0.000073	0.0411	0.0086	0.017	0.017	--	31
VOC	1,1,2-Trichloroethane	mg/kg	2	624	0%	0.000083	0.026	0.015	0.13	0.018	1	4
VOC	1,1-Dichloroethane	mg/kg	--	624	0%	0.000048	0.026	--	--	25	--	--
VOC	1,1-Dichloroethene	mg/kg	--	624	0%	0.00007	0.04	--	--	0.03	--	2
VOC	1,2,3-Trichlorobenzene	mg/kg	6	624	1%	0.00014	0.0411	0.0019	0.034	0.087	--	--
VOC	1,2,3-Trichloropropane	mg/kg	2	624	0%	0.00027	0.23	0.0013	0.5	0.00053	2	514
VOC	1,2,4-Trichlorobenzene	mg/kg	10	637	2%	0.00022	1.5	0.001	0.071	0.85	--	4
VOC	1,2,4-Trimethylbenzene	mg/kg	28	624	4%	0.000093	0.0214	0.00049	0.107	23	--	--
VOC	1,2-Dibromo-3-chloropropane	mg/kg	--	624	0%	0.00015	0.48	--	--	0.00000014	--	624
VOC	1,2-Dibromoethane	mg/kg	4	624	1%	0.00011	0.025	0.00013	0.022	0.00016	3	603
VOC	1,2-Dichlorobenzene	mg/kg	5	637	1%	0.000063	2.3	0.00088	0.06	5.1	--	--
VOC	1,2-Dichloroethane	mg/kg	8	624	1%	0.000054	0.022	0.0012	0.046	0.016	3	5
VOC	1,2-Dichloropropane	mg/kg	11	624	2%	0.000065	0.022	0.0026	0.21	0.018	3	4
VOC	1,3,5-Trimethylbenzene	mg/kg	21	624	3%	0.00004	0.0214	0.00008	0.82	23	--	--
VOC	1,3-Dichlorobenzene	mg/kg	3	637	0%	0.00007	2.1	0.0048	0.058	28	--	--
VOC	1,3-Dichloropropane	mg/kg	--	624	0%	0.000059	0.0214	--	--	0.25	--	--
VOC	1,4-Dichlorobenzene	mg/kg	8	637	1%	0.0001	2.4	0.0048	0.057	0.64	--	4
VOC	2-Butanone	mg/kg	103	624	17%	0.00099	0.27	0.0023	1.7	59	--	--
VOC	2-Chlorotoluene	mg/kg	--	624	0%	0.000051	0.0214	--	--	0.71	--	--
VOC	2-Hexanone	mg/kg	2	624	0%	0.00078	0.27	0.014	0.021	0.011	2	85
VOC	2-Methyl-1-propanol	mg/kg	7	7	100%	--	--	0.0053	0.01	2.3	--	--
VOC	4-Chlorotoluene	mg/kg	1	624	0%	0.000092	0.0214	0.012	0.012	2.5	--	--
VOC	4-Methyl-2-pentanone	mg/kg	3	624	0%	0.00024	0.45	0.0053	0.016	8.1	--	--
VOC	Acetone	mg/kg	215	621	35%	0.001	0.6	0.011	2	88	--	--
VOC	Benzene	mg/kg	143	651	22%	0.000065	0.015	0.00038	0.34	0.025	6	--
VOC	Bromobenzene	mg/kg	--	624	0%	0.000092	0.043	--	--	0.059	--	--
VOC	Bromodichloromethane	mg/kg	1	624	0%	0.000044	0.15	0.0005	0.0005	0.044	--	1
VOC	Bromoform	mg/kg	--	624	0%	0.000071	0.15	--	--	0.34	--	--
VOC	Bromomethane	mg/kg	6	624	1%	0.00032	0.126	0.00059	0.023	0.16	--	--
VOC	Carbon Disulfide	mg/kg	84	612	14%	0.000058	0.0849	0.00013	0.014	12	--	--
VOC	Carbon tetrachloride	mg/kg	--	624	0%	0.000078	0.028	--	--	0.023	--	2
VOC	Chlorobenzene	mg/kg	1	624	0%	0.000054	0.023	0.03	0.03	0.63	--	--
VOC	Chloroethane	mg/kg	--	624	0%	0.00023	0.126	--	--	580	--	--
VOC	Chloroform	mg/kg	154	624	25%	0.000048	0.0214	0.00017	0.75	0.46	4	--
VOC	Chloromethane	mg/kg	20	624	3%	0.000057	0.051	0.00019	0.019	0.21	--	--
VOC	cis-1,2-Dichloroethene	mg/kg	12	624	2%	0.000081	0.038	0.0079	0.029	0.24	--	--
VOC	Dibromochloromethane	mg/kg	1	624	0%	0.00014	0.14	0.044	0.044	0.032	1	1
VOC	Dibromomethane	mg/kg	--	624	0%	0.000087	0.03	--	--	1.1	--	--
VOC	Dichlorodifluoromethane	mg/kg	16	624	3%	0.000072	0.044	0.00188	0.036	140	--	--
VOC	Ethylbenzene	mg/kg	59	651	9%	0.000041	0.031	0.00021	0.2	6.9	--	--
VOC	Hexachlorobutadiene	mg/kg	4	637	1%	0.00017	1.8	0.0015	0.071	0.12	--	4
VOC	Hexane	mg/kg	1	1	100%	--	--	0.012	0.012	6.2	--	--
VOC	Isopropylbenzene	mg/kg	12	624	2%	0.000031	0.0214	0.00024	0.49	51	--	--
VOC	m,p-Xylene	mg/kg	106	624	17%	0.000093	0.0411	0.00017	1.4	1.2	1	--
VOC	Methylene chloride	mg/kg	70	624	11%	0.00012	0.0849	0.00174	3.2	0.016	53	50

TABLE 5-7

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
VOC	Methyl-tert-butyl ether (MTBE)	mg/kg	1	603	0%	0.00008	0.0328	0.00031	0.00031	1.3	--	--
VOC	n-Butylbenzene	mg/kg	2	624	0%	0.000088	0.023	0.0058	0.33	15	--	--
VOC	n-Propylbenzene	mg/kg	8	624	1%	0.000062	0.022	0.00029	0.031	15	--	--
VOC	o-Xylene	mg/kg	48	624	8%	0.000044	0.0304	0.000053	0.14	1.2	--	--
VOC	sec-Butylbenzene	mg/kg	2	624	0%	0.000065	0.0214	0.0027	0.016	12	--	--
VOC	Styrene	mg/kg	6	624	1%	0.000076	0.0214	0.00055	0.41	0.96	--	--
VOC	tert-Butylbenzene	mg/kg	2	624	0%	0.000054	0.0214	0.0053	0.007	12	--	--
VOC	Tetrachloroethene (PCE)	mg/kg	46	624	7%	0.000085	0.0214	0.0084	0.71	0.024	24	--
VOC	Toluene	mg/kg	228	651	35%	0.000044	0.0411	0.00075	1.5	6.5	--	--
VOC	trans-1,2-Dichloroethene	mg/kg	--	624	0%	0.000048	0.23	--	--	0.37	--	--
VOC	Trichloroethene (TCE)	mg/kg	55	624	9%	0.00013	0.026	0.00022	0.33	0.02	32	3
VOC	Trichlorofluoromethane	mg/kg	28	624	4%	0.000054	0.036	0.00024	1.1	86	--	--
VOC	Trichlorotrifluoroethane (Freon 113)	mg/kg	--	1	0%	0.014	0.014	--	--	750	--	--
VOC	Vinyl Acetate	mg/kg	--	17	0%	0.024	0.051	--	--	100	--	--
VOC	Vinyl chloride	mg/kg	1	624	0%	0.000057	0.033	0.02	0.02	0.0085	1	110
VOC	Xylenes, Total	mg/kg	19	133	14%	0.0039	0.173	0.015	0.442	63	--	--
TPH	DRO	mg/kg	371	557	67%	0.3	7.85	0.36	15,000	250	11	--
TPH	GRO	mg/kg	37	512	7%	0.18	11	0.37	630	11,000	--	--
TPH	RRO	mg/kg	403	527	76%	1.6	170	1.7	3,500	300	3	--
SVOC	1,2-Diphenylhydrazine	mg/kg	--	40	0%	0.015	0.015	--	--	0.00027	--	40
SVOC	2,4,5-Trichlorophenol	mg/kg	2	544	0%	0.00096	4.2	0.056	0.11	67	--	--
SVOC	2,4,6-Trichlorophenol	mg/kg	1	544	0%	0.0018	6.1	0.088	0.088	1.4	--	5
SVOC	2,4-Dichlorophenol	mg/kg	2	544	0%	0.0018	2.4	0.054	0.088	1.3	--	1
SVOC	2,4-Dimethylphenol	mg/kg	--	509	0%	0.0017	19	--	--	8.8	--	3
SVOC	2,4-Dinitrophenol	mg/kg	1	544	0%	0.036	76	0.04	0.04	0.54	--	396
SVOC	2-Chloronaphthalene	mg/kg	4	553	1%	0.0017	2.2	0.023	0.29	120	--	--
SVOC	2-Chlorophenol	mg/kg	2	544	0%	0.0016	2.5	0.045	0.073	1.5	--	1
SVOC	2-Methyl-4,6-dinitrophenol	mg/kg	--	544	0%	0.0017	76	--	--	0.0062	--	441
SVOC	2-Methylphenol (o-Cresol)	mg/kg	1	544	0%	0.0017	6.7	0.073	0.073	15	--	--
SVOC	2-Nitroaniline	mg/kg	1	553	0%	0.0027	5.2	0.086	0.086	0.15	--	11
SVOC	3&4-Methylphenol	mg/kg	--	406	0%	0.0029	38	--	--	1.5	--	8
SVOC	3,3'-Dichlorobenzidine	mg/kg	--	547	0%	0.0037	38	--	--	0.19	--	346
SVOC	4-Chloro-3-methylphenol	mg/kg	4	527	1%	0.00088	1.6	0.022	0.095	4.3	--	--
SVOC	4-Chloroaniline	mg/kg	1	553	0%	0.0021	6.7	0.074	0.074	0.057	1	393
SVOC	4-Methylphenol (p-Cresol)	mg/kg	1	137	1%	0.0029	0.017	0.029	0.029	1.5	--	--
SVOC	4-Nitroaniline	mg/kg	1	553	0%	0.0034	4.3	0.11	0.11	0.0014	1	552
SVOC	Aniline	mg/kg	--	5	0%	0.078	0.103	--	--	0.004	--	5
SVOC	Azobenzene	mg/kg	--	244	0%	0.0024	3.1	--	--	0.00096	--	244
SVOC	Benzoic acid	mg/kg	10	529	2%	0.064	19	0.097	0.58	410	--	--
SVOC	Benzyl alcohol	mg/kg	35	536	7%	0.0025	20	0.0042	0.029	0.89	--	11
SVOC	Benzyl butyl phthalate	mg/kg	13	553	2%	0.0015	2.2	0.0021	0.1	920	--	--
SVOC	bis-(2-Chloroethoxy)methane	mg/kg	2	553	0%	0.0013	2.5	0.043	0.066	0.025	2	158
SVOC	bis-(2-Chloroethyl)ether	mg/kg	2	553	0%	0.0024	3.7	0.046	0.054	0.0022	2	551
SVOC	bis(2-Chloroisopropyl)ether	mg/kg	1	553	0%	0.0012	3.7	0.053	0.053	0.00012	1	552
SVOC	bis-(2-Ethylhexyl)phthalate	mg/kg	42	554	8%	0.0017	2.8	0.0018	4.4	13	--	--
SVOC	Carbazole	mg/kg	20	531	4%	0.0013	6.3	0.0015	0.11	6.5	--	--
SVOC	Dibenzofuran	mg/kg	10	553	2%	0.0013	2.1	0.0023	0.099	11	--	--

TABLE 5-7

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
SVOC	Diethyl phthalate	mg/kg	6	553	1%	0.0035	2.3	0.0039	0.11	130	--	--
SVOC	Dimethyl phthalate	mg/kg	4	553	1%	0.0018	2.7	0.032	0.23	1,100	--	--
SVOC	Di-n-butyl phthalate	mg/kg	45	553	8%	0.0026	3	0.0027	0.44	80	--	--
SVOC	Di-n-octyl phthalate	mg/kg	5	553	1%	0.0012	2.8	0.062	0.11	3,800	--	--
SVOC	Hexachlorobenzene	mg/kg	2	553	0%	0.0021	2	0.056	0.11	0.047	2	60
SVOC	Hexachlorocyclopentadiene	mg/kg	--	22	0%	0.025	0.41	--	--	1.3	--	--
SVOC	Hexachloroethane	mg/kg	--	553	0%	0.0022	5.3	--	--	0.21	--	11
SVOC	Isophorone	mg/kg	2	553	0%	0.0012	2	0.041	0.065	3.1	--	--
SVOC	n-Nitrosodimethylamine	mg/kg	1	536	0%	0.0061	4.4	0.061	0.061	0.000053	1	535
SVOC	n-Nitrosodi-n-propylamine	mg/kg	4	553	1%	0.0021	2.1	0.04	0.28	0.0011	4	549
SVOC	n-Nitrosodiphenylamine	mg/kg	2	553	0%	0.0014	2.8	0.056	0.1	15	--	--
SVOC	Pentachlorophenol	mg/kg	12	588	2%	0.0016	36	0.009	0.33	0.047	3	188
SVOC	Phenol	mg/kg	6	544	1%	0.0017	2.2	0.0065	0.071	68	--	--
PESTICIDES	4,4'-DDD	mg/kg	279	564	49%	0.000095	0.00683	0.00012	0.24	7.2	--	--
PESTICIDES	4,4'-DDE	mg/kg	325	564	58%	0.000042	0.0054	0.00011	0.38	5.1	--	--
PESTICIDES	4,4'-DDT	mg/kg	369	566	65%	0.000071	0.14	0.00011	2.2	7.3	--	--
PESTICIDES	Aldrin	mg/kg	--	556	0%	0.000031	0.023	--	--	0.07	--	--
PESTICIDES	alpha-BHC	mg/kg	5	560	1%	0.000106	0.024	0.00033	0.0013	0.0064	--	5
PESTICIDES	beta-BHC	mg/kg	2	566	0%	0.00012	0.036	0.00085	0.037	0.022	1	1
PESTICIDES	Chlordane	mg/kg	--	18	0%	0.00213	0.00213	--	--	2.3	--	--
PESTICIDES	Dieldrin	mg/kg	5	564	1%	0.000041	0.035	0.0017	0.0057	0.0076	--	11
PESTICIDES	Endrin	mg/kg	2	564	0%	0.000094	0.17	0.001	0.0018	0.29	--	--
PESTICIDES	gamma-BHC (Lindane)	mg/kg	14	557	3%	0.00008	0.019	0.0001	0.054	0.0095	4	4
PESTICIDES	gamma-Chlordane	mg/kg	30	564	5%	0.000048	0.036	0.000076	0.0037	0.013	--	5
PESTICIDES	Heptachlor	mg/kg	7	564	1%	0.00008	0.021	0.0003	0.015	0.28	--	--
PESTICIDES	Heptachlor epoxide	mg/kg	5	566	1%	0.000056	0.013	0.00031	0.001	0.014	--	--
PESTICIDES	Methoxychlor	mg/kg	10	562	2%	0.000091	0.14	0.00029	0.0082	23	--	--
PESTICIDES	Toxaphene	mg/kg	1	568	0%	0.0048	2.2	0.027	0.027	3.9	--	--
PCBs	PCB-1016 (Aroclor 1016)	mg/kg	--	499	0%	0.0013	1.8	--	--	0.092	--	3
PCBs	PCB-1221 (Aroclor 1221)	mg/kg	--	499	0%	0.0013	2.2	--	--	0.00012	--	499
PCBs	PCB-1232 (Aroclor 1232)	mg/kg	--	499	0%	0.0013	1.8	--	--	0.00012	--	499
PCBs	PCB-1242 (Aroclor 1242)	mg/kg	--	499	0%	0.000902	1.8	--	--	0.0053	--	428
PCBs	PCB-1248 (Aroclor 1248)	mg/kg	--	499	0%	0.0013	1.8	--	--	0.0052	--	428
PCBs	PCB-1254 (Aroclor 1254)	mg/kg	--	499	0%	0.000879	1.8	--	--	0.0088	--	386
PCBs	PCB-1260 (Aroclor 1260)	mg/kg	127	499	28%	0.00127	0.097	0.0034	0.9	0.024	109	29
PAH	2-Methylnaphthalene	mg/kg	211	610	35%	0.00027	6.2	0.0003	0.21	6.1	--	1
PAH	Acenaphthene	mg/kg	59	610	10%	0.00016	2.2	0.00016	0.55	180	--	--
PAH	Acenaphthylene	mg/kg	27	610	4%	0.00022	2	0.00026	0.23	180	--	--
PAH	Anthracene	mg/kg	89	610	15%	0.00022	3.1	0.00023	0.11	3,000	--	--
PAH	Benzo(a)anthracene	mg/kg	140	610	23%	0.00016	2	0.00031	0.19	3.6	--	--
PAH	Benzo(a)pyrene	mg/kg	145	610	24%	0.00022	2.3	0.00023	0.17	2.1	--	1
PAH	Benzo(b)fluoranthene	mg/kg	155	610	25%	0.00048	2.9	0.00049	0.18	12	--	--
PAH	Benzo(g,h,i)perylene	mg/kg	143	610	23%	0.00023	2.5	0.00024	0.1	38,700	--	--
PAH	Benzo(k)fluoranthene	mg/kg	136	610	22%	0.00029	1.6	0.00035	0.13	120	--	--
PAH	Chrysene	mg/kg	179	610	29%	0.00033	9.7	0.00038	0.2	360	--	--
PAH	Dibenzo(a,h)anthracene	mg/kg	87	610	14%	0.00018	2	0.00021	0.099	4	--	--
PAH	Fluoranthene	mg/kg	198	611	32%	0.00028	3.5	0.00033	0.29	1,400	--	--

TABLE 5-7

Comparison of Summarized Analytical Data to Migration to Groundwater Screening Levels - Subsurface Soil

Remedial Investigation Report

FWA 102 Former Communications Site, Fort Wainwright, Alaska

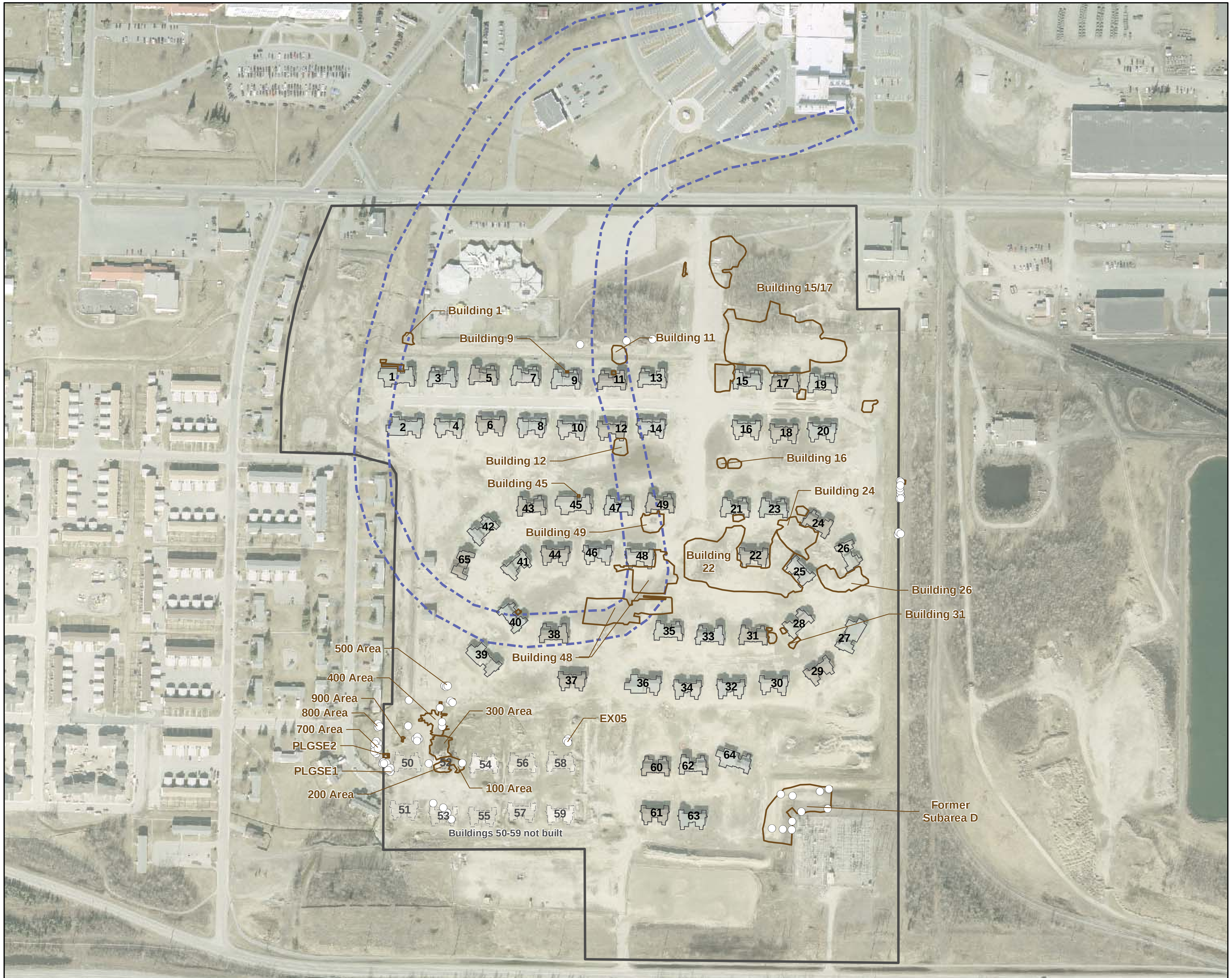
Analytical Group	Analyte (highlighting indicated screening level exceedance)	Units	Number of Detects	Number of Samples	Frequency of Detection	Minimum MDL	Maximum MDL	Minimum Detected Value	Maximum Detected Value	GWP SL	Number of Detects > PSL	Number of Nondetects > PSL
PAH	Fluorene	mg/kg	76	610	12%	0.00019	1.7	0.00019	0.58	220	--	--
PAH	Indeno(1,2,3-cd)pyrene	mg/kg	136	610	22%	0.00024	2.7	0.00024	0.13	41	--	--
PAH	Naphthalene	mg/kg	219	662	33%	0.0002	1.6	0.00033	0.54	20	--	--
PAH	Phenanthrene	mg/kg	260	611	43%	0.00033	1.8	0.00033	0.21	3,000	--	--
PAH	Pyrene	mg/kg	186	611	30%	0.00034	2.4	0.00039	0.28	1,000	--	--
OTHER	1-chloro-1,1-difluoroethane	mg/kg	1	1	100%	--	--	0.0132	0.0132	52	--	--
OTHER	Ethane, 1,1-difluoro-	mg/kg	1	1	100%	--	--	0.018	0.018	28	--	--
OTHER	Pentane	mg/kg	4	4	100%	--	--	0.0064	0.036	10	--	--
HERBICIDES	2,4,5-T	mg/kg	1	368	0%	0.00051	0.25	0.55	0.55	0.15	1	1
HERBICIDES	2,4,5-TP (Silvex)	mg/kg	--	368	0%	0.0019	0.11	--	--	0.19	--	--
HERBICIDES	2,4-D	mg/kg	--	368	0%	0.00071	0.041	--	--	0.21	--	--
HERBICIDES	2,4-DB	mg/kg	--	368	0%	0.0014	0.084	--	--	0.12	--	--
HERBICIDES	Dalapon	mg/kg	1	368	0%	0.0042	0.73	0.17	0.17	0.23	--	10
HERBICIDES	Dicamba	mg/kg	2	368	1%	0.00083	0.048	0.0028	0.0086	0.28	--	--
HERBICIDES	Dinoseb	mg/kg	--	367	0%	0.0021	0.12	--	--	0.32	--	--
HERBICIDES	MCPA (2-Methyl-4-chlorophenoxy acetic acid)	mg/kg	--	368	0%	0.00078	3.3	--	--	0.0047	--	46
HERBICIDES	MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	mg/kg	--	329	0%	0.00092	2.6	--	--	0.011	--	4
EXPLOSIVES	1,3,5-Trinitrobenzene	mg/kg	10	485	2%	0.0089	0.02	0.021	0.065	19	--	--
EXPLOSIVES	1,3-Dinitrobenzene	mg/kg	--	484	0%	0.027	0.05	--	--	0.02	--	484
EXPLOSIVES	2,4,6-Trinitrotoluene	mg/kg	--	484	0%	0.012	0.02	--	--	0.49	--	--
EXPLOSIVES	2,4-Dinitrotoluene	mg/kg	2	601	0%	0.0028	1.1	0.049	0.1	0.0093	2	499
EXPLOSIVES	2,6-Dinitrotoluene	mg/kg	2	600	0%	0.0028	1.6	0.055	0.1	0.0094	2	490
EXPLOSIVES	2-Amino-4,6-dinitrotoluene	mg/kg	--	484	0%	0.026	0.1	--	--	0.056	--	69
EXPLOSIVES	2-Nitrotoluene	mg/kg	--	484	0%	0.028	0.08	--	--	0.025	--	484
EXPLOSIVES	3-Nitrotoluene	mg/kg	1	484	0%	0.0088	0.07	0.075	0.075	4.9	--	--
EXPLOSIVES	4-Amino-2,6-dinitrotoluene	mg/kg	--	484	0%	0.015	0.02	--	--	0.056	--	--
EXPLOSIVES	4-Nitrotoluene	mg/kg	--	484	0%	0.016	0.08	--	--	0.34	--	--
EXPLOSIVES	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	mg/kg	--	484	0%	0.036	0.04	--	--	0.04	--	--
EXPLOSIVES	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	mg/kg	--	484	0%	0.01	0.05	--	--	4.5	--	--
EXPLOSIVES	Nitrobenzene	mg/kg	2	601	0%	0.002	4.1	0.049	0.072	0.094	--	27
EXPLOSIVES	Nitroglycerin	mg/kg	--	69	0%	0.13	0.13	--	--	0.22	--	--
EXPLOSIVES	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	mg/kg	--	484	0%	0.028	0.03	--	--	49	--	--
DIOXIN/FURAN	2,3,7,8-Tetrachlorodibenzo-p-dioxin	pg/g	--	1	0%	0.52	0.52	--	--	0.000058	--	1

Notes:

mg/kg = milligrams per kilogram
pg/g = picograms per gram

VOC = volatile organic compounds
TPH = total petroleum hydrocarbon
SVOC = semi volatile organic compounds
PCBs = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
GEN CHEM = general chemistry

Shaded = detected result exceeds screening criteria.



LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs

Explanation of Label

Location ID
Analyte Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

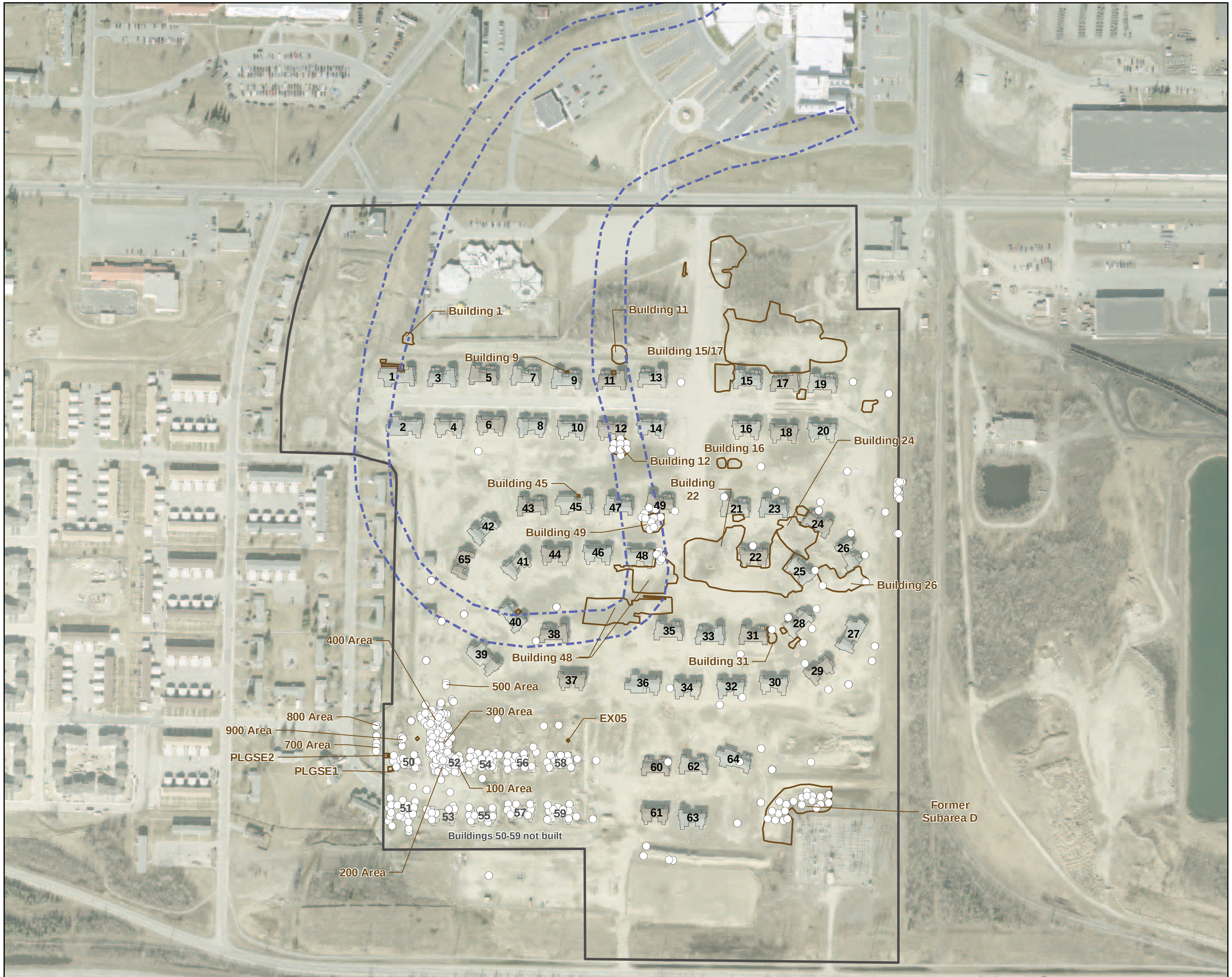
Analyte	Screening Level
PCB-1260 (Aroclor 1260)	1 mg/kg

0 275
Feet

FIGURE 5-1
Distribution of PCB-1260 in Surface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SS.MXD RGRABARE 3/18/2010

CH2MHILL



LEGEND

Site Boundary

Former Hoppe's Slough

PCB and Exploratory Excavation Area

Explanation of Results

No detected exceedances of PSLs

Explanation of Label

Location ID

Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
PCB-1260 (Aroclor 1260)	1 mg/kg

0 275 Feet

FIGURE 5-2
Distribution of PCB-1260 in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SB.MXD RGRABARE 3/18/2010

CH2MHILL

LEGEND

Site Boundary

Former Hoppe's Slough

PCB and Exploratory Excavation Area

Explanation of Results

No detected exceedances of PSLs

One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID
Analyte Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
DRO	1025 mg/kg
RRO	1000 mg/kg
GRO	140 mg/kg

0 275
Feet

FIGURE 5-3
Distribution of Petroleum Hydrocarbons in Surface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SS.MXD RGRABARE 3/18/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

Explanation of Label

Location ID
Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
DRO	1025 mg/kg
RRO	1000 mg/kg
GRO	140 mg/kg

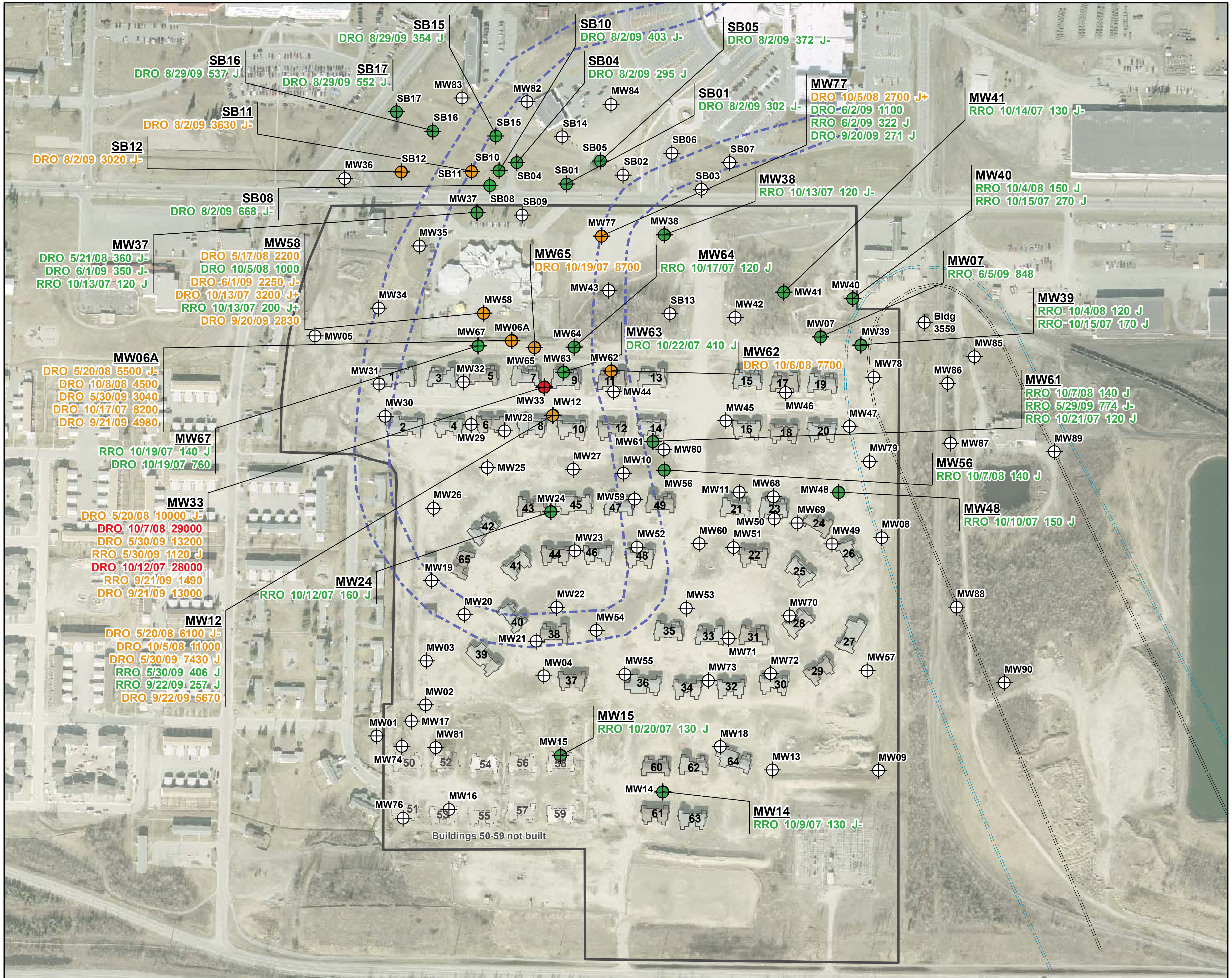
0 275
Feet

N

FIGURE 5-4
Distribution of Petroleum Hydrocarbons in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SB.MXD RGRABARE 3/18/2010

CH2MHILL



LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Explanation of Results

- No detected exceedances of PSLs (3 sample events)
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL
- One or more exceedance of PSL; detected result >100 and =1,000 x PSL

Explanation of Label

Location ID
Analyte Sample Date Result (µg/L) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
DRO	150 ug/l
RRO	110 ug/l
GRO	220 ug/l

NOTE:
5 groundwater sampling events have occurred

0 275
Feet

FIGURE 5-5
Distribution of Petroleum Hydrocarbons in Groundwater
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_GW.MXD 3/21/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

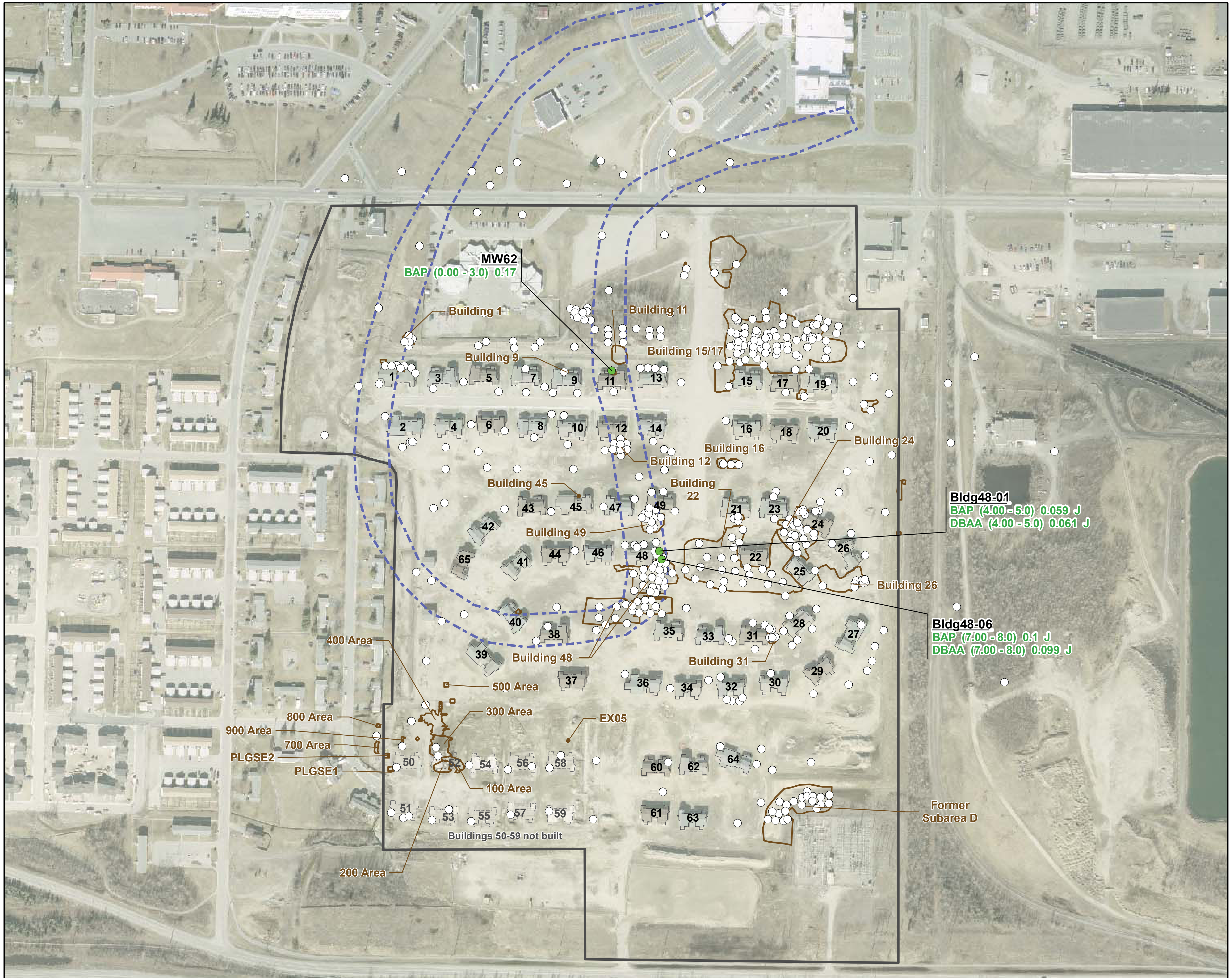
Location ID
Analyte Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
VOCs:	
Benzene	1.1 mg/kg
Ethylbenzene	11 mg/kg
Toluene	22 mg/kg
Xylenes	340 mg/kg
1,2,4-Trimethylbenzene	4.9 mg/kg
1,3,5-Trimethylbenzene	4.2 mg/kg
PAHs:	
Benzo(a)anthracene	0.49 mg/kg
Benzo(a)pyrene	0.049 mg/kg
Benzo(b)fluoranthene	0.49 mg/kg
Dibenz(a,h)anthracene	0.049 mg/kg
Indeno(1,2,3-cd)pyrene	0.49 mg/kg
Napththalene	2.8 mg/kg

0 275
Feet

FIGURE 5-6
Distribution of Petroleum-Related Chemicals in Surface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID
Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
VOCs:	
Benzene	1.1 mg/kg
Ethylbenzene	11 mg/kg
Toluene	22 mg/kg
Xylenes	340 mg/kg
1,2,4-Trimethylbenzene	4.9 mg/kg
1,3,5-Trimethylbenzene	4.2 mg/kg
PAHs:	
Benzo(a)anthracene	0.49 mg/kg
Benzo(a)pyrene	0.049 mg/kg
Benzo(b)fluoranthene	0.49 mg/kg
Dibenz(a,h)anthracene	0.049 mg/kg
Indeno(1,2,3-cd)pyrene	0.49 mg/kg
Napththalene	2.8 mg/kg

0 275
Feet

FIGURE 5-7
Distribution of Petroleum-Related Chemicals in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Explanation of Results

- No detected exceedances of PSLs (3 sample events)
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID
Analyte Sample Date Result (µg/L) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
VOCs:	
Benzene	0.5 ug/l
Ethylbenzene	70 ug/l
Toluene	100 ug/l
Xylenes	120 ug/l
1,2,4-Trimethylbenzene	180 ug/l
1,3,5-Trimethylbenzene	180 ug/l
PAHs:	
Benzo(a)anthracene	0.12 ug/l
Benzo(a)pyrene	0.02 ug/l
Benzo(b)fluoranthene	0.12 ug/l
Dibenz(a,h)anthracene	0.012 ug/l
Indeno(1,2,3-cd)pyrene	0.12 ug/l
Napththalene	73 ug/l

NOTE:
5 groundwater sampling events have occurred

0 275
Feet

FIGURE 5-8
Distribution of Petroleum-Related Chemicals in Groundwater
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

LEGEND

Site Boundary

Former Hoppe's Slough

Explanation of Results

No detected exceedances of PSLs

One or more exceedance of PSL; detected result >1 and ≤10 x PSL

One or more exceedance of PSL; detected result >10 and ≤100 x PS

Explanation of Label

Location ID

Analyte Result (μg/m^3) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
VOCs:	
Benzene	3.1 ug/m^3
Ethylbenzene	22 ug/m^3
Toluene	5210 ug/m^3
1,2,4-Trimethylbenzene	7.3 ug/m^3
1,3,5-Trimethylbenzene	7.3 ug/m^3
PAHs:	
Napththalene	0.72 ug/m^3

NOTE:
Vadose Zone sample locations shown as triangles

0 275
Feet

N

FIGURE 5-9
Distribution of Petroleum-Related Chemicals in Soil Gas
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_GS.MXD 3/21/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs

Explanation of Label

Location ID
Analyte Result (mg/kg) Qualifier

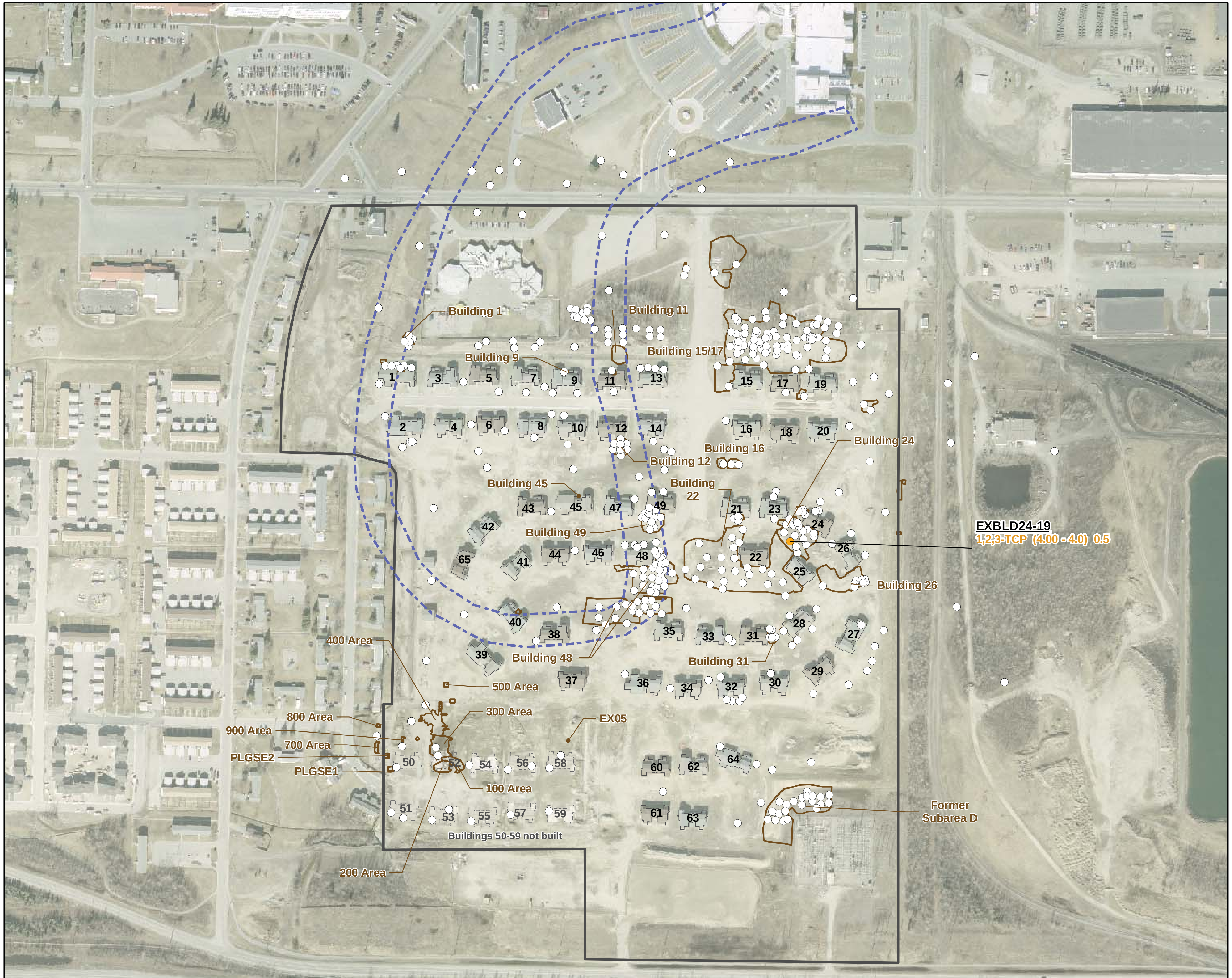
*Font color indicates magnitude of exceedence

Analyte	Screening Level
1,2,3-Trichloropropane	0.017 mg/kg

0 275
Feet

FIGURE 5-10
Distribution of 1,2,3-trichloropropane in Surface Soil

Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

Explanation of Label

Location ID
Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
1,2,3-Trichloropropane	0.017 mg/kg

0 275
Feet

N

FIGURE 5-11
Distribution of 1,2,3-trichloropropane in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SB.MXD RGRABARE 3/18/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Explanation of Results

- No detected exceedances of PSLs (3 sample events)
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

Explanation of Label

Location ID
Analyte Sample Date Result (µg/L) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
1,2,3-Trichloropropane	0.012 ug/l

NOTE:
5 groundwater sampling events have occurred

0 275
Feet

FIGURE 5-12
Distribution of 1,2,3-trichloropropane in Groundwater
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_GW.MXD 3/21/2010

CH2MHILL

LEGEND

Site Boundary

Former Hoppe's Slough

Explanation of Results

No detected exceedances of PSLs

One or more exceedance of PSL; detected result >10 and ≤100 x PS

Explanation of Label

Location ID

Analyte Result (µg/m^3) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
1,2,3-Trichloropropane	0.012 ug/m^3

NOTE:
Vadose Zone sample locations shown as triangles

0 275
Feet

FIGURE 5-13
Distribution of 1,2,3-trichloropropane in Soil Gas
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_GS.MXD 3/21/2010

CH2MHILL

LEGEND

Site Boundary

Former Hoppe's Slough

PCB and Exploratory Excavation Area

Explanation of Results

No detected exceedances of PSLs

One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID

Analyte Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

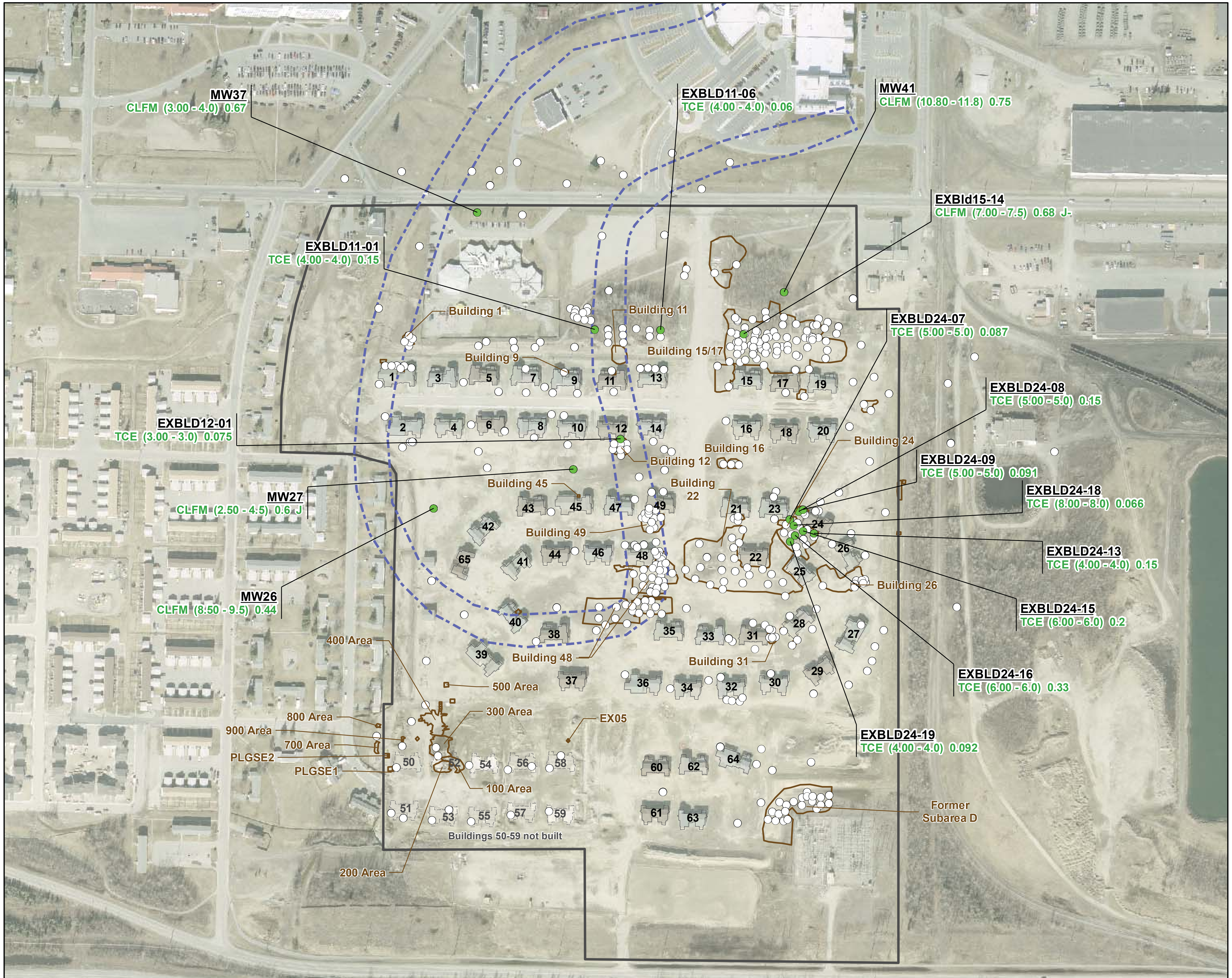
Analyte	Screening Level
1,1,2,2-Tetrachloroethane	0.55 mg/kg
1,1,2-Trichloroethane	1.1 mg/kg
1,1-Dichloroethene	0.085 mg/kg
1,2-Dichloroethane	0.48 mg/kg
1,2-Dichloropropane	0.53 mg/kg
1,2,4-Trichlorobenzene	4.1 mg/kg
Carbon tetrachloride	0.31 mg/kg
Chloroform	0.32 mg/kg
cis-1,2-Dichloroethene	13 mg/kg
Hexachlorobutadiene	0.38 mg/kg
Tetrachloroethene (PCE)	1 mg/kg
Trichloroethene (TCE)	0.057 mg/kg
Vinyl chloride	0.43 mg/kg

0 275
Feet

FIGURE 5-14
Distribution of Chlorinated VOCs in Surface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SS.MXD RGRABARE 3/18/2010

CH2MHILL



LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID
Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

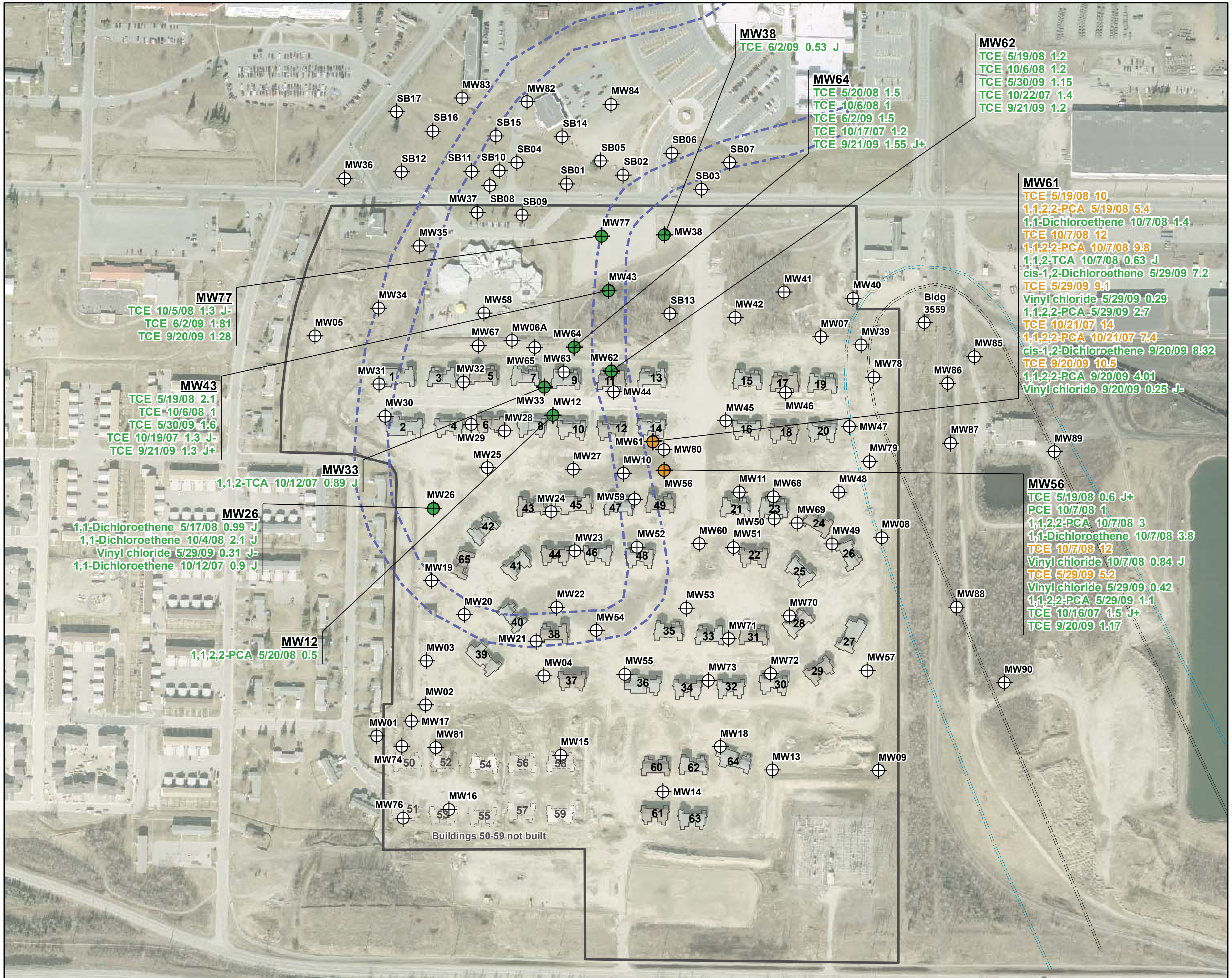
Analyte	Screening Level
1,1,2,2-Tetrachloroethane	0.55 mg/kg
1,1,2-Trichloroethane	1.1 mg/kg
1,1-Dichloroethene	0.085 mg/kg
1,2-Dichloroethane	0.48 mg/kg
1,2-Dichloropropane	0.53 mg/kg
1,2,4-Trichlorobenzene	4.1 mg/kg
Carbon tetrachloride	0.31 mg/kg
Chloroform	0.32 mg/kg
cis-1,2-Dichloroethene	13 mg/kg
Hexachlorobutadiene	0.38 mg/kg
Tetrachloroethene (PCE)	1 mg/kg
Trichloroethene (TCE)	0.057 mg/kg
Vinyl chloride	0.43 mg/kg

0 275
Feet

FIGURE 5-15
Distribution of Chlorinated VOCs in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SB.MXD RGRABARE 3/18/2010

CH2MHILL



LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Explanation of Results

- No detected exceedances of PSLs (3 sample events)
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

Explanation of Label

Location ID
Analyte Sample Date Result (µg/L) Qualifier

*Font color indicates magnitude of exceedence

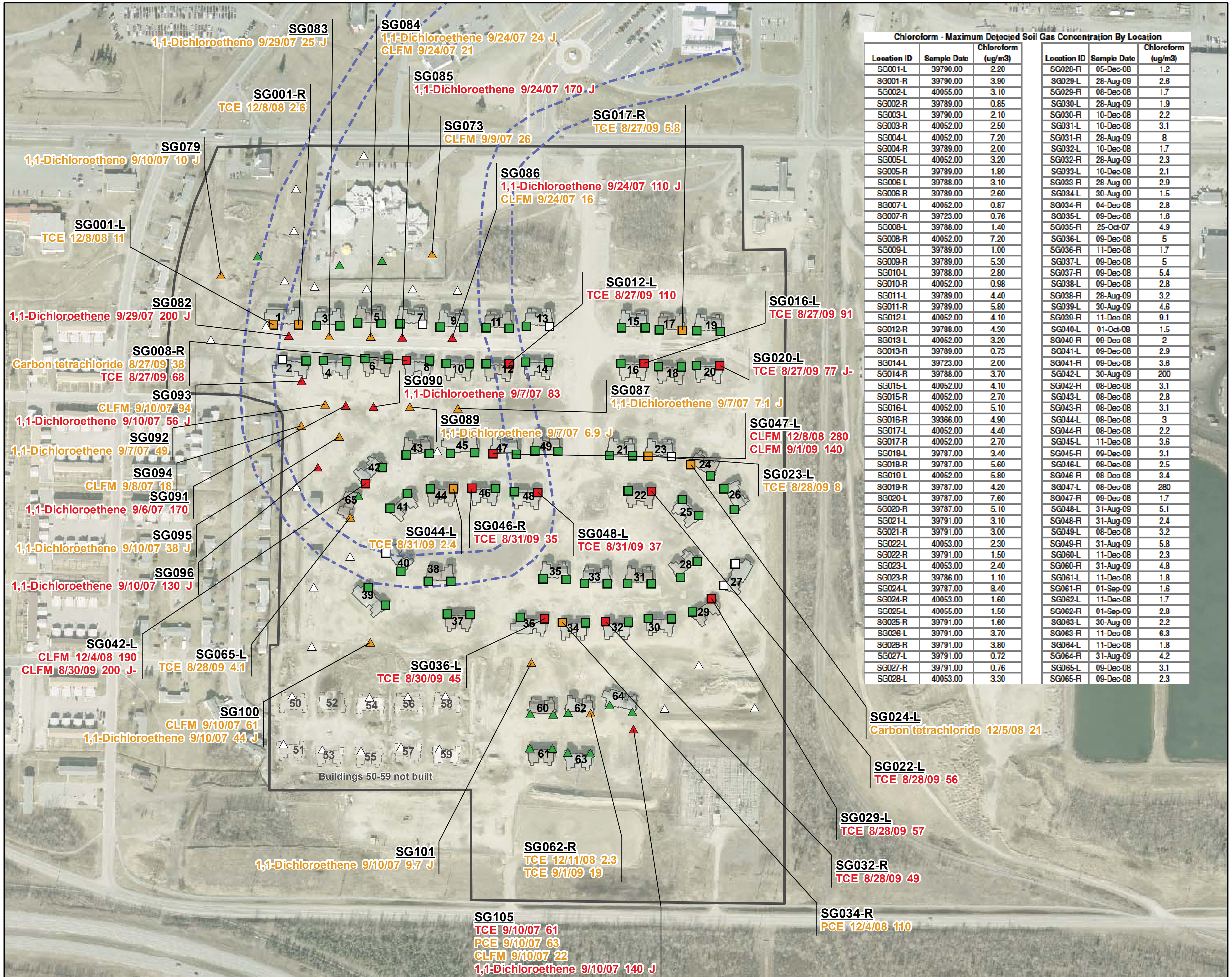
Analyte	Screening Level
1,1,2,2-Tetrachloroethane	0.43 ug/l
1,1,2-Trichloroethane	0.5 ug/l
1,1-Dichloroethene	0.7 ug/l
1,2-Dichloroethane	0.5 ug/l
1,2-Dichloropropane	0.5 ug/l
1,2,4-Trichlorobenzene	7 ug/l
Carbon tetrachloride	0.5 ug/l
Chloroform	14 ug/l
cis-1,2-Dichloroethene	7 ug/l
Hexachlorobutadiene	0.72 ug/l
Tetrachloroethene (PCE)	0.5 ug/l
Trichloroethene (TCE)	0.5 ug/l
Vinyl chloride	0.2 ug/l

NOTE:
5 groundwater sampling events have occurred

0 275
Feet

FIGURE 5-16
Distribution of Chlorinated VOCs in Groundwater
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_GW.MXD 3/21/2010



Chloroform - Maximum Detected Soil Gas Concentration By Location

Location ID	Sample Date	Chloroform (ug/m3)	Location ID	Sample Date	Chloroform (ug/m3)
SG001-L	39790.00	2.20	SG028-R	05-Dec-08	1.2
SG001-R	39790.00	3.90	SG029-L	28-Aug-09	2.6
SG002-L	40055.00	3.10	SG029-R	08-Dec-08	1.7
SG002-R	39789.00	0.85	SG030-L	28-Aug-09	1.9
SG003-L	39790.00	2.10	SG030-R	10-Dec-08	2.2
SG003-R	40052.00	2.50	SG031-L	10-Dec-08	3.1
SG004-L	40052.00	7.20	SG031-R	28-Aug-09	8
SG004-R	39789.00	2.00	SG032-L	10-Dec-08	1.7
SG005-L	40052.00	3.20	SG032-R	28-Aug-09	2.3
SG005-R	39789.00	1.80	SG033-L	10-Dec-08	2.1
SG006-L	39788.00	3.10	SG033-R	28-Aug-09	2.9
SG006-R	39789.00	2.60	SG034-L	30-Aug-09	1.5
SG007-L	40052.00	0.87	SG034-R	04-Dec-08	2.8
SG007-R	39723.00	0.76	SG035-L	09-Dec-08	1.6
SG008-L	39788.00	1.40	SG035-R	25-Oct-07	4.9
SG008-R	40052.00	7.20	SG036-L	09-Dec-08	5
SG009-L	39789.00	1.00	SG036-R	11-Dec-08	1.7
SG009-R	39789.00	5.30	SG037-L	09-Dec-08	5
SG010-L	39788.00	2.80	SG037-R	09-Dec-08	5.4
SG010-R	40052.00	0.98	SG038-L	09-Dec-08	2.8
SG011-L	39789.00	4.40	SG038-R	28-Aug-09	3.2
SG011-R	39789.00	5.80	SG039-L	30-Aug-09	4.6
SG012-L	40052.00	4.10	SG039-R	11-Dec-08	9.1
SG012-R	39788.00	4.30	SG040-L	01-Oct-08	1.5
SG013-L	40052.00	3.20	SG040-R	09-Dec-08	2
SG013-R	39789.00	0.73	SG041-L	09-Dec-08	2.9
SG014-L	39723.00	2.00	SG041-R	09-Dec-08	3.6
SG014-R	39788.00	3.70	SG042-L	30-Aug-09	200
SG015-L	40052.00	4.10	SG042-R	08-Dec-08	3.1
SG015-R	40052.00	2.70	SG043-L	08-Dec-08	2.8
SG016-L	40052.00	5.10	SG043-R	08-Dec-08	3.1
SG016-R	39366.00	4.90	SG044-L	08-Dec-08	3
SG017-L	40052.00	4.40	SG044-R	08-Dec-08	2.2
SG017-R	40052.00	2.70	SG045-L	11-Dec-08	3.6
SG018-L	39787.00	3.40	SG045-R	09-Dec-08	3.1
SG018-R	39787.00	5.60	SG046-L	08-Dec-08	2.5
SG019-L	40052.00	5.80	SG046-R	08-Dec-08	3.4
SG019-R	39787.00	4.20	SG047-L	08-Dec-08	280
SG020-L	39787.00	7.60	SG047-R	09-Dec-08	1.7
SG020-R	39787.00	5.10	SG048-L	31-Aug-09	5.1
SG021-L	39791.00	3.10	SG048-R	31-Aug-09	2.4
SG021-R	39791.00	3.00	SG049-L	08-Dec-08	3.2
SG022-L	40053.00	2.30	SG049-R	31-Aug-09	5.8
SG022-R	39791.00	1.50	SG060-L	11-Dec-08	2.3
SG023-L	40053.00	2.40	SG060-R	31-Aug-09	4.8
SG023-R	39786.00	1.10	SG061-L	11-Dec-08	1.8
SG024-L	39787.00	8.40	SG061-R	01-Sep-09	1.6
SG024-R	40053.00	1.60	SG062-L	11-Dec-08	1.7
SG025-L	40055.00	1.50	SG062-R	01-Sep-09	2.8
SG025-R	39791.00	1.60	SG063-L	30-Aug-09	2.2
SG026-L	39791.00	3.70	SG063-R	11-Dec-08	6.3
SG026-R	39791.00	3.80	SG064-L	11-Dec-08	1.8
SG027-L	39791.00	0.72	SG064-R	31-Aug-09	4.2
SG027-R	39791.00	0.76	SG065-L	09-Dec-08	3.1
SG028-L	40053.00	3.30	SG065-R	09-Dec-08	2.3

LEGEND

Site Boundary

Former Hoppe's Slough

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PS
- One or more exceedance of PSL; detected result >100 and ≤1,000 x PSL

Explanation of Label

Location ID
Analyte Result (μg/m³) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
1,1,2,2-Tetrachloroethane	0.42 ug/m³
1,1,2-Trichloroethane	1.5 ug/m³
1,1-Dichloroethene	0.49 ug/m³
1,2-Dichloroethane	0.94 ug/m³
1,2-Dichloropropane	1.3 ug/m³
1,2,4-Trichlorobenzene	4.2 ug/m³
Carbon tetrachloride	1.6 ug/m³
Chloroform	1.1 ug/m³
cis-1,2-Dichloroethene	37 ug/m³
Hexachlorobutadiene	1.11 ug/m³
Tetrachloroethene (PCE)	4.1 ug/m³
Trichloroethene (TCE)	0.22 ug/m³
Vinyl chloride	0.81 ug/m³

NOTE:
Vadose Zone sample locations shown as triangles

0 275
Feet

N

FIGURE 5-17
Distribution of Chlorinated VOCs in Soil Gas
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

LEGEND

Site Boundary

Former Hoppe's Slough

PCB and Exploratory Excavation Area

Explanation of Results

No detected exceedances of PSLs

Explanation of Label

Location ID

Analyte Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
Explosives:	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	7.2 mg/kg
Pesticides:	
4,4'-DDT	2.1 mg/kg
Dieldrin	0.032 mg/kg
gamma-BHC (Lindane)	0.56 mg/kg
Heptachlor	0.13 mg/kg
SVOCs:	
bis-(2-Ethylhexyl)phthalate	22 mg/kg
n-Nitrosodimethylamine	0.016 mg/kg
n-Nitrosodi-n-propylamine	0.052 mg/kg

0 275
Feet

FIGURE 5-18
Distribution of Pesticides, Herbicides, SVOCs and Explosives in Surface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

\\JAFAR\PROJ\TAKUGARDENS_357465\MAPFILES\RI_2010\NE_EXCEEDANCES_SS.MXD RGRABARE 3/18/2010

CH2MHILL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- PCB and Exploratory Excavation Area

Explanation of Results

- No detected exceedances of PSLs
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL

Explanation of Label

Location ID
Analyte (Depth in ft) Result (mg/kg) Qualifier

*Font color indicates magnitude of exceedence

Analyte	Screening Level
Explosives:	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	7.2 mg/kg
Pesticides:	
4,4'-DDT	2.1 mg/kg
Dieldrin	0.032 mg/kg
gamma-BHC (Lindane)	0.56 mg/kg
Heptachlor	0.13 mg/kg
SVOCs	
bis-(2-Ethylhexyl)phthalate	22 mg/kg
n-Nitrosodimethylamine	0.016 mg/kg
n-Nitrosodi-n-propylamine	0.052 mg/kg

0 275
Feet

FIGURE 5-19
Distribution of Pesticides, Herbicides, SVOCs and Explosives in Subsurface Soil
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

LEGEND

- Site Boundary
- Former Hoppe's Slough
- 1,000 gpm Pumping Rate Water Supply Capture Zone
- 1,700 gpm Pumping Rate Water Supply Capture Zone

Explanation of Results

- No detected exceedances of PSLs (3 sample events)
- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

Explanation of Label

Location ID
Analyte Sample Date Result (µg/L) Qualifier

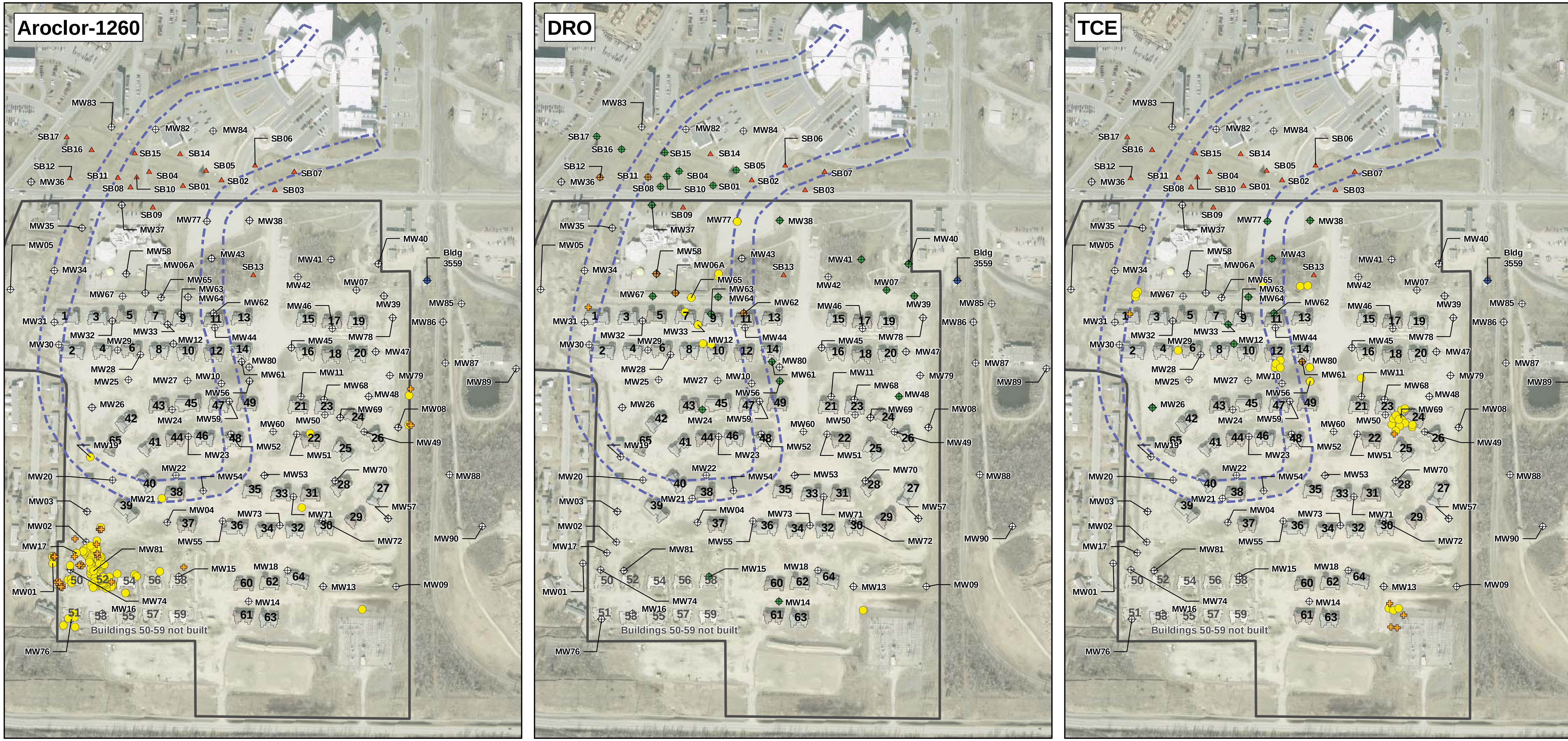
*Font color indicates magnitude of exceedence

Analyte	Screening Level
Explosives:	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	0.77 ug/l
Pesticides:	
4,4'-DDT, Dieldrin	0.25 ug/l
gamma-BHC (Lindane)	0.02 ug/l
Heptachlor	0.04 ug/l
SVOCs:	
bis-(2-Ethylhexyl)phthalate	0.6 ug/l
n-Nitrosodimethylamine	0.0017 ug/l
n-Nitrosodi-n-propylamine	0.012 ug/l

NOTE:
5 groundwater sampling events have occurred

0 275
Feet

FIGURE 5-20
Distribution of Pesticides, Herbicides, SVOCs and Explosives in Groundwater
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



LEGEND

- Site Boundary
- Former Hoppe's Slough
- Aroclor-1260 Exceedance in Subsurface Soil
- Aroclor-1260 Exceedance in Surface Soil

Groundwater Sample Locations

- Monitoring Well Location
- Water Supply Well Location
- Direct-push Grab Sample Location

LEGEND

- Site Boundary
- Former Hoppe's Slough
- DRO Exceedance in Subsurface Soil
- DRO Exceedance in Surface Soil

Groundwater Sample Locations

- Monitoring Well Location
- Water Supply Well Location
- Direct-push Grab Sample Location

Groundwater Exceedances

- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL
- One or more exceedance of PSL; detected result >100 and =1,000 x PSL

LEGEND

- Site Boundary
- Former Hoppe's Slough
- TCE Exceedance in Subsurface Soil
- TCE Exceedance in Surface Soil

Groundwater Sample Locations

- Monitoring Well Location
- Water Supply Well Location
- Direct-push Grab Sample Location

Groundwater Exceedances

- One or more exceedance of PSL; detected result >1 and ≤10 x PSL
- One or more exceedance of PSL; detected result >10 and ≤100 x PSL

0 300
Feet

N

FIGURE 5-21
Comparison of Migration to Groundwater Screening Level Exceedances in Soil to Exceedances of PSLs in Groundwater (Aroclor-1260, DRO, and TCE)
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

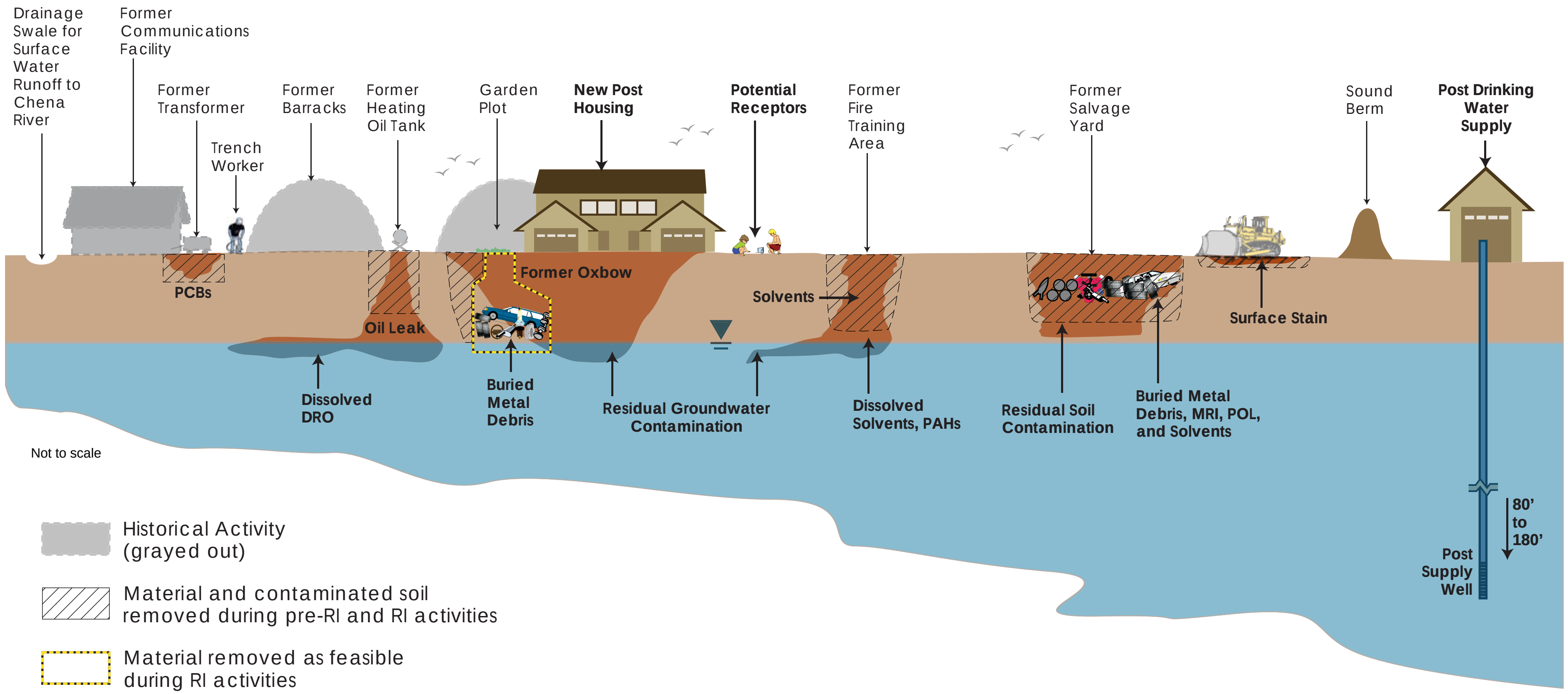


FIGURE 5-22
Conceptual Site Model
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

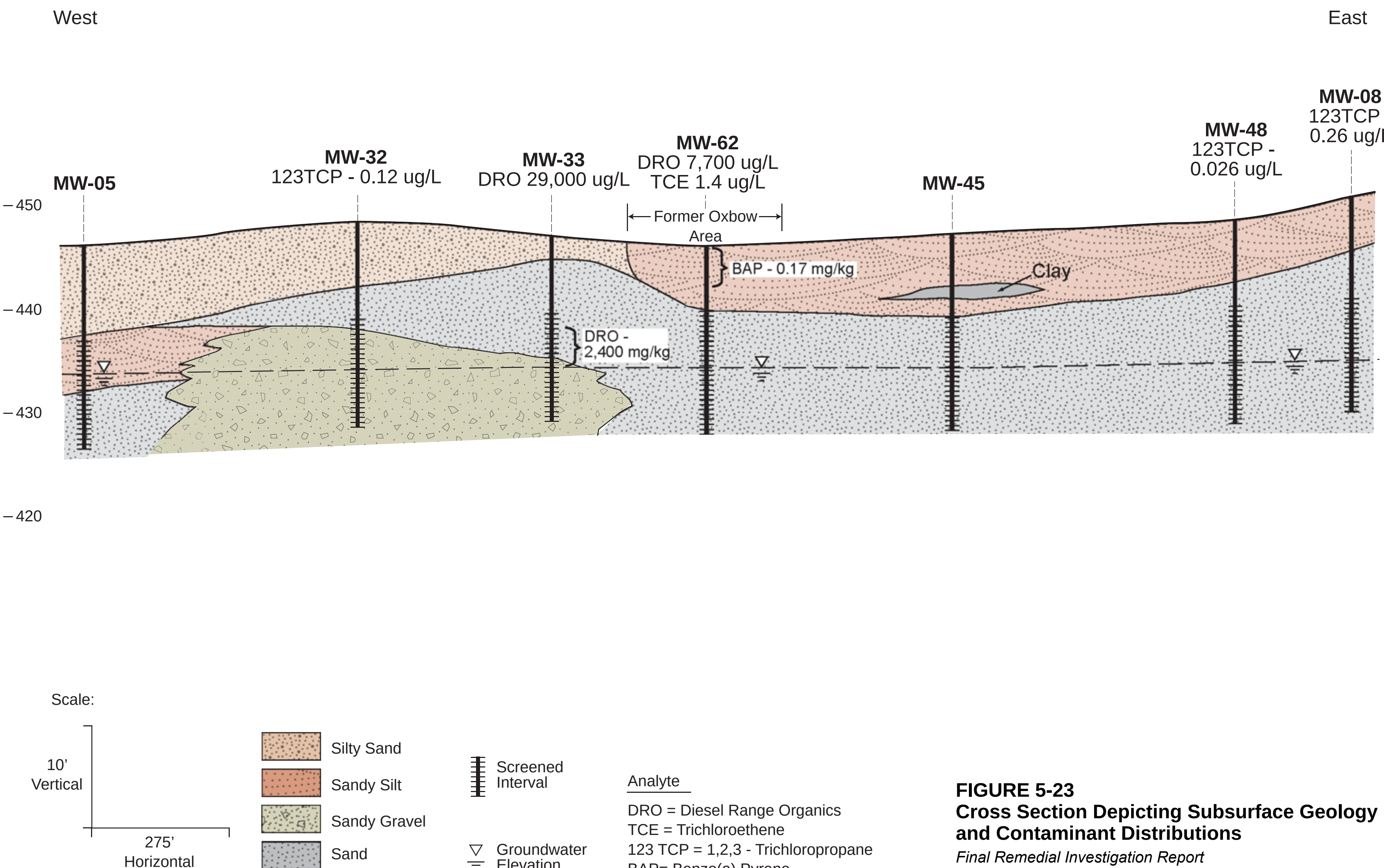


FIGURE 5-23
Cross Section Depicting Subsurface Geology and Contaminant Distributions
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

SECTION 6

Military Munitions Investigation Activities and Hazard Assessment

The military munitions investigation activities and associated hazard assessment were executed by Jacobs under contract to the USACE (Contract No. W911KB-06-D-0006). The following section of this report is an adaptation of the military munitions investigation activities report and hazard assessment produced by Jacobs in June 2009.

6.1 Geotechnical Activities

In the spring of 2004, geotechnical activities were performed during the planning phase for construction of military family housing on property known as Taku Gardens. During intrusive activities near the post gas station metallic debris, munitions debris, and DMM were discovered. One old-style bomb fin assembly, two inert fragments of a 37-mm projectile, one empty 75-mm recoilless rifle cartridge, and five 8-inch M106 projectiles were found during intrusive activities. Army EOD personnel were contacted and removed these items. None of the munitions contained explosive filler; they were inert. Table 6-1 lists the nomenclature and classification of the munitions located during the 2004 geotechnical activities.

6.2 Housing Construction

In the spring of 2005, construction of military housing began on property known as Taku Gardens. During construction, buried debris was routinely discovered, removed, and taken to the Fort Wainwright Landfill. In addition to the metallic debris, one 8-inch M106 projectile was found during intrusive activities. Army EOD personnel were contacted and removed this item. The projectile did not contain explosive filler; it was inert. Table 6-2 lists the nomenclature and classification of the munitions located during the 2005 construction season.

6.3 Records Search

During the winter of 2005/2006, a review of historical records revealed the DRMO had used the eastern side of the property for the disposal of unserviceable equipment and other debris by burial. The Army evaluated this information and determined that an RI needed to be conducted.

6.4 2006 Investigations

During the summer of 2006, an intrusive investigation by a separate contractor and with UXO-qualified personnel revealed munitions-related items, buried drums, and large quantities of scrap metal were still buried onsite. During the 2006 investigation, the major items of interest were two unfuzed M47 bombs that were located; one of which contained a liquid suspected to be mustard agent. After professional analysis by the U.S. Army TEU and the material assessment review board (MARB), it was determined by using a PINS field unit that the liquid was water and no trace of chemicals was present. The MARB findings and final report may be found in Appendix I. In addition to the two M47s, six other unfuzed munitions suspected of containing explosives were located and turned over to the Army EOD for disposal by detonation. After detonation, all five items were completely destroyed by an excessive amount of donor charges that made positive identification of the type of filler (empty, inert, or explosive) impossible. Other munitions-related items were located, inspected for explosives and explosive residues, and determined to be free of hazardous or explosive material and disposed of in the Fort Wainwright Landfill. After initial intrusive investigations revealed the presence of buried munitions, the contractor demobilized. Table 6-3 lists the nomenclature and classification of the munitions located during the 2006 investigation.

6.5 2007 Investigations

In the summer of 2007, Jacobs mobilized to the site with UXO-qualified personnel and resumed the intrusive investigation. Three unfuzed 20-pound AN-M41 fragmentation bombs and two unfuzed 8-inch M106 8-inch projectiles were located. These five munitions were identified in the field as being live (containing explosive filler) and turned over to the Army EOD for positive identification and disposal. After detonation, all five items were completely destroyed by an excessive amount of donor charges that made positive identification of the type of filler (empty, inert, or explosive) impossible. Other munitions-related items were located, inspected for explosives and explosive residues, and determined to be free of hazardous or explosive material and disposed of in the Fort Wainwright Landfill. In the fall of 2007, all fieldwork was suspended because of weather and field crews demobilized. Table 6-4 lists the nomenclature and classification of the munitions located during the 2007 investigation.

6.6 2008 Investigations

In the spring of 2008, Jacobs remobilized to the site with UXO-qualified personnel and resumed intrusive investigations. Nine unfuzed 8-inch M106 projectiles, 13 unfuzed 20-pound AN-M41 fragmentation bombs, four M47 smoke bombs with burster tube (suspected to be filled with explosives), one M75 smoke bomb with burster tube (suspected to be filled with explosives), and two 3- to 5-inch unfired rocket motors, with an M29 inert fuze, were located. These 29 munitions were identified in the field as being live (containing explosive filler) and turned over to the Army EOD for positive identification and disposal. After the items had been detonated with an appropriately sized donor charge, 27 of the 29 munitions were confirmed to have contained inert filler or were empty and were reclassified as munitions debris. The two 3.5-inch unfired rocket motors contained propellant and were destroyed. Other munitions-related items were located, inspected for explosives and explosive residues and determined to be free of hazardous or explosive material and turned over to a local scrap dealer that placed them into a smelter for recycling. In the fall of 2008, intrusive investigations were completed and fieldwork was suspended because of the weather. Table 6-5 lists the nomenclature and classification of the munitions located during the 2008 investigation.

None of the munitions located contained a fuze, except the 3.5-inch rocket motors that were fitted with the M29 inert fuze and used for training. The two unfired 3.5-inch rocket motors with M29 inert fuzes that were removed and disposed of in 2008 had propellant residue in the motor, but were fitted with inert warheads. These rockets were identified as having propellant in the motors because they both had arming wires protruding from the tail.

6.7 2009 Investigations

No munitions-related items were found during the 2009 investigations and excavations.

6.8 Summary

Because different contractors performed intrusive investigations with either no UXO-qualified personnel and/or different UXO-qualified personnel, and different Army EOD personnel disposed of the munitions, it is not possible to prove conclusively that military munitions buried at the FCS were not explosively filled. However, there are several lines of evidence that demonstrate that this is the case: no fuzed munitions were located, no fuzes were located separately, and no fuze shipping or storage containers for munitions that might have contained a fuze(s) were located. The munitions identified by Army EOD in 2006 and 2007 as high-explosive munitions are suspect because of the excessive donor charge used to detonate the items and because the same types of items were recovered in later years and these later found items were conclusively determined not to contain explosive filler.

Based on the types of munitions located and results of military EOD disposal activities, the Army's third-party UXO expert has concluded that no fuzed or unfuzed explosively filled munitions were ever present within the FCS. The Army does realize that this determination cannot be absolute because there were a number of different contractors who performed excavation for construction or intrusive work associated with the investigation, there was some early intrusive work conducted without UXO-qualified personnel present, and a number of different military EOD personnel responded to dispose of the suspected DMM. This conclusion was reached using professional judgment and considered that the results of field activities gave no indication that hazardous DMM was present. This conclusion is based upon the following facts:

- No fuzed munitions were found.
- No fuzes were found either separately or in a fuze container.
- When detonated with the appropriate donor charge, the suspected 8-inch M106 projectiles, M41 fragmentation bombs, and M47 smoke bombs were all empty or filled with plaster.
- Those suspected M106, M41, and M47 destroyed in 2007 were destroyed using very large amounts of donor explosives and, thus, left no evidence.
- DMM has been found in only one section of this housing area, also known as Subarea A.
- All EM-61 anomalies identified by the Army, EPA, and ADEC for investigation have been completely removed.

- An additional 10 percent of the unknown anomalies greater than 75 mV were investigated as a means of providing "ground truthing" that the smaller anomalies do not contain either drums with hazardous materials or DMM.
- An additional ground truthing effort was conducted on anomalies of less than 75 mV throughout the entire compound, which provided additional evidence that anything less than 75 mV was caused by one of the following: small pockets of construction debris; small pockets of banding material; bundles of discarded communication wire; miscellaneous fasteners; or high concentrations of rust in the soil.
- The contractor UXO personnel onsite for the last 2 years inspected large quantities of scrap metal found both prior to their arrival and uncovered during the investigation. Only two live rocket motors (3.5-inch M29 rockets) used in training were determined to be DMM.
- Over 7.5 acres of land at the FCS were excavated to depths of up to 18 feet during the drum and debris investigation at the FCS, again with only the two previously mentioned rocket motors confirmed to be DMM.

6.9 Conclusion

Based on evidence collected during this extensive investigative effort, the Army determined that, regarding the issue of explosives safety, the Taku Gardens family housing development is safe for residential use. It is extremely unlikely that any explosive ordnance is present at the site and, furthermore, the probability of encounter by residents with any buried munitions that might be present is unlikely.

TABLE 6-1
MEC Located in 2004

2004 Season	Quantity
Munitions Debris (MD)	
Bomb Fins (old style box)	1
Projectile Fragments, 37 mm	2
Projectile, 8-inch M 106, Practice/Inert	5
Cartridge Case, 75-mm RR, empty	1
Total	**9**

TABLE 6-2
MEC Located in 2005

2005 Season	Quantity
Munitions Debris (MD)	
Projectile, 8-inch M106 Practice/Inert	1
Total	**1**

TABLE 6-3
MEC Located in 2006

2006 Season	Quantity
Munitions Debris (MD)	
57-mm RR Cartridge Case	Unknown
Bomb, M47 Smoke	4
Projectile, 8-inch M106 Practice/Training	2
Smoke Tank, M10	Unknown
Total	**6 Plus**
Range Related Debris (RRD)	
Container, 105mm Howitzer	Unknown
Container, 75mm Projectile	Unknown
Container, Shipping 2.36-inch Rocket	Unknown
Container, Ammunition	Unknown
Total	**Unknown**
Discarded Military Munitions (DMM)	
Bomb, M41 20lb Fragmentation[a]	1
Bomb, M47 Chemical Smoke[a]	2
Rocket, 3.5-inch T-85[a]	1
Total	**4**

[a]These items were identified by the contractor as live, with explosive filler; after disposal by Army EOD, they were determined to be inert

TABLE 6-4
MEC Located in 2007

2007 Season	Quantity
Munitions Debris (MD)	
40mm Dummy Cart M17	3
57mm RR Cartridge Case	2
75mm RR Cartridge Case	10
Bomb Fins, (20-lb Fragmentation Bomb)	1
Bomb Fins, GP	1
Bomb, M37 17-lb Practice	1
Bomb, M38A1 Smoke	1
Bomb, M75 Smoke	1
Hand Grenade, MK 2 Practice	1
JATO Bottle	15
Mortar Tail, 60mm Illumination	1
Rocket Fins 2.75-inch	2
Rocket Fins 5-inch	6
Rocket Fuze, M6 Dummy	44
Rocket Fuze, MK3 Dummy	2
Rocket Motor 4.5-inch	4
Rocket Motor, 2.25-inch SCAR	1
Rocket, 3.5-inch M29 Practice	27
VB-3 Guided Bomb Elec. Section	19
Total	**142**
Range Related Debris (RRD)	
Container, 105-mm Howitzer	451
Container, 75-mm Projectile	84
Container, M29 Practice Rocket	125
Container, Mortar	15
Total	**675**
Discarded Military Munitions (DMM)	
Bomb, M41 20-lb Fragmentation [a]	3
Projectile, 8-inch M106 [a]	2
Total	**5**

TABLE 6-5
MEC Located in 2008

2008 Season	Quantity
Munitions Debris (MD)	
40-mm Cart Case	2
40-mm Dummy Cart M17	10
57-mm RR Cartridge Case	21
75-mm RR Cartridge Case	47
Arming Vane for Bomb Tail Fuze	55
Bomb Fins, (20-lb Fragmentation Bomb)	0
Bomb Fins, GP	17
Bomb, M37 17-lb Practice	11
Bomb, M38A1 Smoke	8
Bomb, M41 20-lb Fragmentation	2
Bomb, M47 Smoke	7
Bomb, M75 Smoke	4
Hand Grenade, MK 2 Practice	2
JATO Bottle	90
Mortar Tail, 60-mm Illumination	1
Mortar, 81-mm Practice M68 w/M3 Cart	0
Parachute Assembly (20-lb Fragmentation Bomb)	135
Projectile, 8-inch M106	0
Rifle Grenade, M11 Series, Practice	2
Rocket Fins 2.75-inch	1
Rocket Fins 5-inch	503
Rocket Fuze, M6 Dummy	484
Rocket Fuze, MK3 Dummy	9
Rocket Motor 4.5-inch	4
Rocket Motor, 2.25-inch SCAR	21
Rocket, 3.5-inch M29 Practice	168
Smoke Tank, M10	4
Total	**1668**
Range Related Debris (RRD)	
Container, 105-mm Howitzer	410
Container, 75-mm Projectile	3

TABLE 6-5
MEC Located in 2008

2008 Season	Quantity
Container, M29 Practice Rocket	3
Container, M7 Teargas Grenade	1
Container, Mortar	2
Total	**419**
Discarded Military Munitions (DMM)	
Bomb, M41 20-lb Fragmentation[a]	13
Bomb, M47 Smoke[a]	4
Bomb, M75 Smoke[a]	1
Projectile, 8-inch M106[a]	9
Rocket, 3.5-inch M29 Practice (residue in motor)	2
Total	**29**

[a]After detonation, the filler was identified as inert, or no filler present.

SECTION 7

Human Health and Ecological Risk Assessments

This section provides the results of the human health risk assessment (HHRA) and ecological risk assessment (ERA) for the FCS. The risk assessments seek to determine the nature, magnitude, and probability of actual or potential harm to public health, safety, welfare, or the environment by the threatened or actual release of hazardous substances. The assessments identify and characterize the toxicity of the COPCs, potential exposure pathways, potential human and ecological receptors, and likelihood and extent of impact or threat under current and reasonably anticipated future land and water use conditions (EPA, 2002).

The procedures and assumptions used are as described in the *Human Health and Ecological Risk Assessment Work Plan, FWA 102 Former Communications Site Fort Wainwright, Alaska* (CH2M HILL, 2007f) and are intended to be in accordance with both EPA and ADEC guidance on risk assessment. As part of the State of Alaska requirements for conducting risk assessments in accordance with Title 18, Chapter 75, of the *Alaska Administrative Code* (AAC), and as outlined in the *Risk Assessment Procedures Manual* (ADEC, 2009b), several meetings between the Army, EPA, and ADEC have been held from 2007 to 2010 for purposes of scoping the conduct of this risk assessment.

The results of the risk assessments, along with other factors, are expected to serve as the basis for FCS risk management decisions. The overall objective of the risk assessments is to identify whether any risk to human health and the environment posed by the FCS is of sufficient magnitude to support a remedial decision.

These risk assessments specifically evaluate the potential exposures from chemicals detected in environmental media at the FCS; they do not address hazards associated with munitions-related items. The assessment of hazards associated with munitions-related items is included in Section 6.

This risk assessment evaluates potential future exposures to recreational/site visitors, maintenance workers, and excavation workers that may use the site in the future. The HHRA evaluates two additional exposure cases, each with distinct sets of assumptions as follows:

- Case 1. The **reasonably anticipated future use (residential) scenario**. This case includes consideration of existing restrictions that preclude digging onsite, and prevent use of groundwater from areas outside the existing FWA water supply wells. This exposure case includes potential exposures to soil in the top 2 feet bgs, groundwater from wells within the FWA supply well capture zone, and indoor air vapor originating from subslab soil-gas.
- Case 2. The **hypothetical unrestricted exposure scenario.** This case evaluates the no-action scenario and includes conservative default assumptions regarding domestic

use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media. Indoor air exposure is also included as part of the hypothetical unrestricted exposure case.

When interpreting the results of the HHRA, it is critical that there be logical separation between these two evaluation approaches, and a clear understanding of the intended uses of the respective results for decision making.

7.1 Organization of the Risk Assessments

The risk assessments include the following components:

- **Introduction**—describes the purpose and organization of the risk assessments and the risk assessment guidance used to characterize risk (see Sections 7.1 and 7.2).
- **Selection of Chemicals of Potential Concern**—describes the process for identifying which data are the focus of the human and ecological risk evaluations, and identifies the chemicals considered for the risk quantification processes (see Section 7.3).
- **Conceptual Site Model**—provides a summary of the physical setting, land uses, water beneficial uses, climate, and ecological setting, and wildlife associated with the FCS. This section (see Section 7.4) also identifies the pathways by which human and ecological exposures could occur.
- **Human Health Risk Assessment**—provides the results of the human exposure assessment, toxicity assessment, and risk characterization (see Section 7.5).
- **Ecological Risk Assessment**—provides a summary of the results of Phases 1 and 2 of the ERA, ecoscoping and screening, respectively (see Section 7.6).
- **Uncertainties and Assumptions**—discusses the uncertainties and assumptions associated with the HHRA and ERA (see Section 7.7).

References cited in Section 7 are included in Section 9 of this report.

7.2 Guidance

This HHRA was conducted using the following EPA and ADEC regulatory guidance documents:

- *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual, Part A* (Interim Final) (EPA, 1989)
- *Risk Assessment Procedures Manual* (Draft) (ADEC, 2009b)
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment* (Final) (EPA, 2004a)
- *Vapor Intrusion Guidance for Contaminated Sites* (Draft) (ADEC, 2009a)
- *Soil Screening Guidance: Users Guide* (EPA, 1996a)

- *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA, 2009b)

This ERA was conducted using the following EPA and ADEC regulatory guidance documents:

- *Guidelines for Ecological Risk Assessment* (EPA, 1998)
- *Risk Assessment Procedures Manual* (Draft) (ADEC, 2009b)
- *Ecoscoping Guidance* (ADEC, 2009c)
- *Sediment Quality Guidelines* (ADEC, 2004a)
- *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund* (EPA, 1997b)

7.3 Chemicals of Potential Concern

The COPCs[1] are those chemicals that are carried through the risk quantification process. This section summarizes those chemicals detected in environmental media at the FCS and identifies the COPCs for media that are potentially accessible for human or ecological exposures. During the course of the risk assessments, the COPCs were evaluated to identify and prioritize which chemicals, if any, are estimated to pose unacceptable risks.

7.3.1 Data Used in the Risk Assessments

The analytical data used in the risk assessments include data from surface soil (0 to 2 feet bgs), subsurface soil (0 to 15 feet bgs), drainage swale sediment (0 to 2 feet bgs), subslab soil-gas, and groundwater samples collected during various field investigations conducted during pre-RI (pre-2007), and the 2007, 2008, and 2009 RI activities. These investigations are described in Sections 3 and 4. Samples used in the risk assessments are listed by medium, sample identification number, date of collection, sampling depth interval, and target receptor types in Appendix M, Tables M-1 through M-4. Information about the samples used for the risk assessments is provided by medium in the following sections.

Soil and Drainage Swale Sediment Data

The locations of surface soil and drainage swale sediment samples used for the risk assessments are shown on Figure 3-5. The locations of subsurface soil samples used for the risk assessments are shown in Figure 3-6 and also include samples shown in Figure 3-5. The numbers of specific sample types used in the risk assessments are identified below:

- Surface soil—347 samples collected between 0 and 2 feet bgs
- Subsurface soil—1,500 samples collected between 0 and 15 feet bgs
- Drainage swale sediment—3 samples collected in drainage swales[2]

[1] COPCs as described here should be distinguished from COIs, discussed in Section 5. COIs are those chemicals with one or more exceedances of the project screening levels, which are conservative risk-based values used to evaluate the nature and extent of contamination at the FSC.

[2] These three samples were judgmentally collected at locations where the highest concentrations were anticipated and are considered adequate for decisions regarding offsite migration into this intermittent drainage during snowmelt. The swale has been re-engineered/improved and is now gravel lined.

Subslab Soil-Gas Data

Subslab soil-gas samples were evaluated comprehensively on an individual housing unit basis. Subslab soil-gas sample locations are shown on Figure 7-1. The specific samples used in the risk assessments include 110 individual housing units. To provide some indication of the potential confounding influences from ambient air sources (that is, offsite anthropogenic sources), ambient air samples were also collected from each of two outdoor sampling locations (one at the east fence and one at the west fence). A total of 10 ambient air samples were collected throughout the course of the RI.

Additional information pertaining to the subslab soil-gas sampling is provided in Section 2.3.3 of this report and in Appendix S. This additional information includes SOPs for the installation and sampling of the subslab soil-gas probes, as well as construction details of the garage floor slabs and the various duplex model types.

Groundwater Data

Groundwater data used in the risk assessments were collected during five semiannual sampling events in 2007, 2008, and 2009 (October 2007, May 2008, October 2008, May-June 2009, and August-September 2009).

The two primary beneficial uses of groundwater are as follows:

1. As a potential future source of domestic water for residential use (drinking water, showering, irrigation). Two exposure cases were evaluated:

- **Reasonably anticipated future use (residential) scenario:** Two capture zones were modeled for the FWA water supply wells at Building 3559 to provide hypothetical bounding estimates on potential water use: one for the lower end of the anticipated future pumping rate (1,000 gpm) and one for the high-end of the range (1,700 gpm). These values bracket the actual (as evidenced by data records from 2005 to 2010) long-term production rate of 1,327 gpm, as described in Section 2.1.5.

- **Hypothetical unrestricted exposure scenario:** To evaluate the no-action scenario, a conservative default assumption regarding domestic use of groundwater anywhere across the site was included for this exposure case.

2. As a source of recharge water to offsite surface water (Chena River). Represented by analytical data from 10 groundwater samples collected in the downgradient monitoring wells (see Figure 3-7; MW35, MW36, MW37, MW38, MW40, MW41, MW77, MW82, MW83, and MW84) nearest the Chena River.

A complete description of water use is provided in Section 2.1.5. Groundwater flow direction and well locations are shown on Figure 2-2.

7.3.2 Data Usability Evaluation

To determine whether available analytical data were suitable for use in the risk assessments, a data usability evaluation, which was performed as part of the RI, considered the following two primary lines of evaluation:

1. Identification of the adequacy of MDLs for available analytical data to detect potential risks posed by the FCS (see Section 5 and Appendix H)

2. Evaluation of the spatial, chemical, and temporal representativeness of the available analytical data, which included an assessment of whether these data are relevant to plausible exposure pathways at the FCS

These criteria were considered collectively to judge whether FCS data were usable and representative of exposure for the risk assessment, and to identify any associated uncertainties to be reported as uncertainties for the risk assessments (see Section 7.7).

Data Usability Conclusions

The following conclusions resulted from a review of the existing data:

The soil, drainage swale sediment, groundwater, and subslab soil-gas data collected for the RI are considered to have adequate levels of detection for assessment of risk.

Historical surface soil (after site development) and subsurface soil data from past investigations are considered representative and usable for risk assessment, particularly when supplemented with the additional data collected during the RI. Because of the history of investigations and removal actions completed at the FCS, soil sampling strategies have been both judgmental and systematic across the FCS. Judgmental samples were collected, for example, as confirmation samples at targeted drum and debris removal areas where geophysical anomalies were observed and at known or suspected hot spot areas. Because the sampling was roughly evenly spaced with high spatial density across the FCS, and soil was analyzed for all suspected contaminants, it is anticipated that the data generally reflect what people could be exposed to if they reside, visit, or work at the FCS.

Because subslab soil-gas sampling included complete coverage of all 110 residential living units, the sampling was roughly evenly spaced with adequate spatial density across the FCS.

Groundwater data collected before the RI (pre-2007) lack temporal representativeness. Therefore, the data collected from monitoring wells during the RI (2007 through 2009) are considered the most representative of current site conditions. These data were collected near or downgradient of potential source areas, were analyzed for all suspected contaminants, and provide a conservative evaluation of the current and future conditions at the FCS.

7.3.3 Data Processing Procedures

With consideration of the data usability conclusions and in accordance with EPA guidance, the following factors were considered in identifying COPCs at the FCS:

- Identification of detected chemicals
- Background concentration levels of inorganics
- Identification of essential nutrients
- Availability of toxicity factors

COPCs were identified separately for surface soil, subsurface soil, drainage swale sediment, subslab soil-gas, and groundwater. Evaluation of the risk assessment data using these criteria is discussed in the following sections.

Identification of Detected Chemicals

All chemicals detected (including estimated detections) were included as potential COPCs.

Background Concentration Levels for Inorganics

The inorganic chemicals found at the FCS occur naturally at varying background levels. Sampling conducted previously to establish background concentrations in soil present at Fort Wainwright (USACE, 1994) were used to establish whether FCS arsenic concentrations are within levels typical of background near the FCS. Appendix K provides the methodology and results of the background comparison for arsenic. For soil, only arsenic was considered for exclusion from the exposure estimates because arsenic concentrations are within levels typical of background near the FCS.[3]

For groundwater, detected metals below levels reported to be naturally occurring were excluded from the exposure estimates. As described in Section 3.2.3, background concentrations were obtained from the Army (USACE, 1994) for arsenic, barium, cadmium, chromium, and lead; and from the OU-07 Record of Decision, Eielson Air Force Base, Alaska (EPA, 2004b) for aluminum, iron, and manganese. Concentrations in each well below these values are excluded from the well-specific risk estimates. The remaining metals (those above background and those without background values), are carried through the risk assessment for each well.

Identification of Essential Nutrients

Essential nutrients are those chemicals considered essential for human nutrition. Recommended daily allowances are developed for essential nutrients to estimate safe and adequate daily dietary intakes (National Academy of Sciences, 1989). Because calcium, magnesium, potassium, and sodium are considered to be naturally occurring essential nutrients and are generally recognized as being of low toxicity, they were excluded from further consideration as COPCs.

Availability of Toxicity Factors

Only those chemicals that have a toxicity factor available from a reliable source (as defined in Section 7.5.3) were included in the risk assessments as COPCs. For some chemicals without toxicity factors, a surrogate toxicity factor for a structurally similar chemical (when available) was used. For example, the toxicity factor for acenaphthene was used for acenaphthylene, for which none was available. In cases for which the species of metal is unknown, the HHRA conservatively assumed the most toxic form is present. For example, the HHRA assumed that total chromium present in soil at the FCS is in the form of hexavalent chromium.

7.3.4 Summary of COPCs Selected for the Risk Assessments

This section provides a summary of the COPCs selected for surface soil, subsurface soil, drainage swale sediment, subslab soil-gas, and groundwater. The evaluation of direct contact with surface soil for the future maintenance worker, recreational/site visitor, and reasonably anticipated future use (residential) scenarios consider sample depths to 2 feet bgs. The evaluation of direct contact with subsurface soil for the future excavation worker and hypothetical unrestricted exposure scenarios consider sample depths to 15 feet bgs. Summary statistics were not calculated; instead, individual sample data were used in the risk assessments. All analytical data are provided in Appendix M:

---

[3] Per EPA guidance (EPA, 2002), risk estimates for natural levels of arsenic are discussed in the uncertainties section.

- **Surface Soil.** A total of 126 chemicals were detected at least once in FCS surface soil samples and were identified as COPCs for the future maintenance worker, future recreational/site visitor, and reasonably anticipated future use (residential) scenarios.
- **Subsurface Soil.** A total of 160 chemicals were detected at least once in FCS subsurface soil samples and were identified as COPCs for the future excavation worker and hypothetical unrestricted exposure scenarios.
- **Drainage Swale Sediment.** A total of 41 chemicals were detected at least once in the sediment samples at drainage swales and were identified as COPCs for both human health and ecological exposure scenarios.
- **Subslab Soil-Gas.** A total of 54 chemicals were detected at least once in subslab soil-gas samples and were identified as COPCs for the future indoor residential exposure scenario.
- **Capture Zone Groundwater.** A total of 40 chemicals were detected at least once in these groundwater data from wells within the hypothetical high-end 1,700-gpm capture zone and were identified as COPCs for the reasonably anticipated future use (residential) scenario.
- **Groundwater Outside of Capture Zone.** A total of 103 chemicals were detected at least once in groundwater from wells outside the hypothetical high-end 1,700-gpm capture zone, and were identified as COPCs for the hypothetical unrestricted exposure scenario (assuming that groundwater can be used anywhere across the site) for the HHRA. A total of 41 chemicals were detected at least once in downgradient perimeter wells (that is, wells nearest to exposure points along the northern edge of the FCS) and were identified as COPCs for screening during the ERA.

7.3.5 Exposure Point Concentrations

Exposure point concentrations (EPC) are estimated chemical concentrations that a receptor could contact and are specific to each exposure medium. For the incidental ingestion and dermal routes, EPCs were represented by concentrations directly measured in FCS media. For the inhalation route, EPCs for ambient and indoor air pathways were estimated from soil, subslab soil-gas, and/or groundwater using the modeling approaches described in the exposure assessment (see Section 7.5.2). EPCs for risk estimation for each exposure medium were as follows:

Soil

- EPCs for the future maintenance worker and recreational/site visitor were conservatively assumed to be maximum detected concentrations in surface soil (0 to 2 feet bgs) at the FCS.
- EPCs for the future excavation worker were conservatively assumed to be maximum detected concentrations in subsurface soil (0 to 15 feet bgs) at the FCS.
- EPCs for future residents were conservatively assumed to be sample-specific detected concentrations in surface soil (0 to 2 feet bgs).

- EPCs for the hypothetical unrestricted exposure scenario were assumed to be sample-specific detected concentrations in subsurface soil (0 to 15 feet bgs) at the FCS.

Indoor Air

For the indoor air pathway, each of the 110 residential units present at the FCS was evaluated independently. Detected VOC concentrations from subslab soil-gas samples from each housing unit were adjusted by using a site-specific soil-gas to indoor air attenuation factor (see Appendix N) to derive EPCs for the future residential indoor air exposure scenario. For locations where subslab soil-gas was sampled and analyzed during both December 2008 and August 2009, the annual average concentration was considered most representative of chronic exposure, commensurate with the toxicity factors used for risk assessment.

Groundwater

For the groundwater use pathway, each of the 88 well points present at the FCS was evaluated independently. Well-specific maximum detected groundwater concentrations collected during five semiannual sampling events between 2007 and 2009 were used as EPCs for both the reasonably anticipated future use (residential) scenario and the hypothetical unrestricted exposure scenario.[4]

7.4 Revised Conceptual Exposure Model

A CEM provides a framework for understanding site-specific features and physical processes that influence the potential for risk and describes potential human and ecological exposure pathways for site-related chemicals. Contaminant sources and COIs are described in Section 5. The development of this revised CEM was a dynamic process that was based on currently available site information and existing levels of contamination, the latest understanding of reasonably anticipated future land and water uses, and reasonably anticipated future exposure scenarios. The CEM for the FCS included the following components:

- **Sources of COPCs.** These are further described in Section 1, based on known historical uses, practices, and releases at the FCS.
- **Receptors.** These are human and ecological populations potentially exposed to the chemicals of potential concern at or in the locality of the FCS.
- **Pathways.** These describe the mechanism through which a chemical could come into contact with receptors. An exposure pathway is considered complete when a contaminant can be tracked from its source to a receptor.

To define plausible exposure pathways for the FCS, it was critical to understand factors that influence exposure, such as current and reasonably anticipated future land use, beneficial water uses, and climate. These site-specific factors are summarized in the following sections and further described in Sections 1 through 3:

- Site description and historical uses

[4] For computation of multi-media risk under the hypothetical unrestricted exposure scenario, the well point with the highest risk was conservatively used.

- Characterization of current and future land use
- Water beneficial uses
- Climate
- Ecological setting
- Potentially complete human and ecological exposure pathways

7.4.1 Site Background

This section describes the physical setting, land uses, water beneficial uses, climate, ecological setting, and wildlife associated with the FCS.

Site Description

Currently, the FCS encompasses the nearly completed Taku Gardens family housing development, a subdivision which includes 110 new, presently unoccupied residences intended to house FWA military personnel and their families. Little written documentation exists that describes historical activities occurring at the FCS during the course of its use, although there is evidence of varied uses in the area, including the following:

- A salvage/reclamation yard occupying much of the FCS
- Disposal of debris/salvage material in the former Hoppe's Slough channel, which extends through the FCS, in trenches in the salvage yard area, and possibly in other local depressions
- Garden plots
- Barracks and company headquarters extending into the northwest corner of the FCS
- Possible ammunition storage
- Communications and radar systems
- Possible firefighting-training activities (as evidenced by potential circular fire pits and a partially dismembered aircraft)

When site clearing commenced for the housing area construction in 2003, onsite personnel began encountering metal debris on the ground surface. This discovery resulted in the first geotechnical investigations. During the construction, contractors discovered additional metal debris, munitions-related items, petroleum, and PCB contamination, which resulted in further investigation into historical past uses of the area and limiting site access to authorized personnel. One area where PCBs have been detected at high concentrations was made an EZ with additional access restrictions. The Taku Gardens subdivision covers approximately 54 acres; however, the contamination associated with past uses of the FCS might have extended beyond the boundaries of this area.

Geology. FWA and the adjacent Fairbanks area are part of the Highlands Area of the Interior Alaska and Western Alaska Physiographic Province. This province is underlain by metamorphic rocks of the Yukon-Tanana Terrain. The metamorphic rocks west of Fort Wainwright are known as the Birch Hill Sequence and are located approximately 400 feet below the floodplain of the Tanana and Chena Rivers.

Overlying the Birch Hill Sequence is as much as 400 feet of fluvial deposits, which embody the unconfined aquifer known as the Chena Formation. These alluvial sediments aggraded primarily from net deposition from the Tanana River (Pewe et al., 1976; Anderson, 1970; Nelson, 1978).

FWA is underlain by soil and unconsolidated sediment that consists of silt, sand, and gravel, ranging in thickness from 10 feet to more than 400 feet above bedrock. A 5-foot-thick surficial layer of fine-grained soil overlies the deeper alluvial deposits. Alluvial floodplain deposits underlay the surface soils and consist of varying proportions of sand and gravel, which are commonly layered. Where present, permafrost forms discontinuous confining layers that influence groundwater movement and distribution. The depth to permafrost, when present, generally ranges from 2 to 40 feet bgs, but permafrost on FWA has been measured as deep as 150 feet bgs. The greater depths are found on cleared and developed land surfaces, where thermal degradation of underlying permafrost occurs. Regionally, the thickness of the permafrost intervals varies from about 5 to 275 feet. The seasonal frost layer (or active layer) varies between 2 and 12 feet thick (Ecology & Environment, Inc., 1993b). Permafrost has only been reported in borings advanced in the southeastern portion of the FCS.

Hydrogeology. The main aquifer in the FWA area is the Tanana Basin alluvial aquifer, a buried river valley. This aquifer ranges from a few feet thick at the base of Birch Hill to at least 300 feet thick under the main cantonment area of the post. The aquifer could reach a thickness of 700 feet in the Tanana River valley.

Groundwater movement between the Tanana and Chena Rivers generally follows a northwest regional direction, similar to the flow direction of the rivers. Seasonal changes in groundwater flow directions of up to 180 degrees are not uncommon adjacent to the rivers because of the effects of changing river stages in the Tanana and Chena Rivers. Groundwater levels near the Chena River fluctuate greatly because of river stage and interactions with the Tanana River. Typically, groundwater levels rise during spring breakup and late summer runoff and drop during fall and winter when rainfall decreases and precipitation becomes snow.

The Tanana Basin alluvial aquifer beneath FWA consists of deposits of the Chena Formation that vary in texture from sandy silt to coarse sandy gravel. The Chena Formation has a relatively high horizontal hydraulic conductivity in this area, estimated to be as high as 600 feet per day, and the vertical hydraulic conductivity has been estimated to be approximately 30 feet per day (USGS, 1996). The Chena Formation deposits are extensive and, thus, provide a large capacity for groundwater storage.

Groundwater in the Tanana-Chena floodplain generally is considered to be unconfined in permafrost-free areas. In wells drilled through the permafrost, however, the aquifer exhibits the characteristic of a confined aquifer. Here, the groundwater rises to levels above the deepest extent of the permafrost, which acts as a confining layer. The fact that these levels are similar to those of wells completed in unfrozen alluvium supports the interpretation that the basin alluvium is a single-unit aquifer (USACE, 1991). Rates of movement for water and contaminants in frozen, porous soils depend on the overall temperature of the system, thermal gradient, occurrence of interconnected films of unfrozen water, and general continuity of the permafrost. Previous studies indicate that the permafrost containing large, interconnected films of unfrozen water is most likely to be composed of fine-grained materials (silt and clay sizes). When encountered, permafrost should not be regarded as an impermeable material, but rather as a material of very low hydraulic conductivity (Sloan and van Everdingen, 1988).

Characterization of Land Use. The FCS is zoned and planned for future residential uses for Army families that will be stationed at the post. The FCS is currently vacant and fenced, preventing current use. In addition to the specific yard areas near the residential buildings, other common areas and open space that could be used by all residents or other site visitors are indicated on the construction design. These include recreational areas such as playgrounds, a sledding hill, and ice skating rink.

Water Beneficial Use—Groundwater and Surface Water. Groundwater is the only source of potable water used at FWA and in the Fairbanks area. Approximately 95 percent of the potable water on FWA is supplied through a single distribution system fed by two large-capacity wells in Building 3559 (see Figure 1-2). These wells are completed at a depth of approximately 200 feet bgs and provide an average of approximately 59.2 million gallons of water per month to the FWA water treatment plant for processing and distribution. Average water production for the period January 2005 through August 2010 are provided in Table 2-1 and detailed in Appendix B. The water production system at Building 3559 is capable of producing 2,400 gpm; however, this rate is only attained during short-term tests of the system. Average monthly pumping rates for the period January 2005 through August 2010 were between 294 and 2,167 gpm, with an average pumping rate of 1,327 gpm. In addition to the main drinking water supply wells, five emergency standby supply wells are located around the cantonment area. These wells are completed between 80 and 120 feet bgs and are capable of pumping approximately 250,000 gallons per day per well. Regional groundwater also serves as recharge to the Chena River during most of the year.

The Chena River is located about 1,500 feet north of the FCS, draining approximately 2,000 square miles, and flows into the Tanana River approximately 8 miles west-southwest of FWA. The river is seasonally used for recreational hunting and fishing, trapping, subsistence, and boating. The Chena River supports seasonal populations of fish for recreation and provides spawning areas for salmon. Fishing in the river is catch and release only, regulations established by Alaska Department of Fish and Game for protection arctic grayling in the river.

Climate. FWA is in the continental climate zone of interior Alaska. This zone is generally characterized by extreme summer and winter temperatures and light precipitation. Surface winds are generally light (Selkregg, 1976.) Average monthly mean temperatures range from a minimum of -18.7 degrees Fahrenheit (°F) in January to 72.3°F in July. The area is classified as semi-arid, with average annual total precipitation of approximately 10.5 inches, including an annual average snowfall of 67 inches.

During most of the year, prevailing winds are from the north at an average 5.15 mph. However, in June and July, winds are typically from the southwest at an average of 6.9 mph (Ecology and Environment, Inc., 1993a). Winds are strongest in May, at an average of 7.7 mph. Because of generally low wind speeds, moderate to heavy ice fog is prevalent in the area during cold weather (HLA, 1996.)

Ecological Setting. The FCS is bordered by residential housing to the west, Alder Avenue to the south, the Alaska Railroad to the east, and the School Age Services property to the north. The FCS is located in the Tanana-Kuskokwim Lowlands, and consists of relatively flat terrain with no active surface water bodies. Human-made drainage swales have been installed south to north along the west side between the existing housing and the Taku Gardens subdivision, and also east to west along northwest section. These swales are expected to contain flowing water only for a short time during the spring runoff season each year.

Wildlife. The FCS is currently almost completely devoid of vegetation because of clearance activities to support construction. The area is also surrounded by an 8-foot chain link fence topped with three-strand barbed wire. Because access to the area by larger terrestrial organisms is limited by the fence, and very little vegetation exists onsite to provide food or cover for birds or smaller terrestrial organisms, the area is considered generally inadequate habitat for wildlife species. As development and occupation continue, activities will further discourage use of the site by wildlife.

The Chena River supports seasonal populations of fish for recreation and provides spawning areas for salmon. Mammals found around the installation include grizzly bear, black bear, wolverine, Dahl sheep, caribou, fox, weasel, lynx, and beaver, although none of these species would be expected to frequent the investigation area. The only amphibian found at FWA is the wood frog. Several upland game species are found on the installation as well as many other bird species. Wildlife that could occur around the installation, including threatened and endangered or special-status species, are further described in Section 2.7.

7.4.2 Exposure Pathway Analysis

This section describes the means by which receptors (people or animals) at or near the FCS could come into contact with chemicals in exposure media. It addresses exposures that could result under reasonably anticipated potential uses of the FCS and the surrounding areas in the future.

An exposure pathway can be described as the physical course that a COPC takes from the point of release to a receptor. Chemical intake or route of exposure is the means by which a COPC enters a receptor. For an exposure pathway to be complete, all of the following components must be present:

- A source
- A mechanism of chemical release and transport
- An environmental transport medium
- An exposure point
- An exposure route
- A receptor or exposed population

In the absence of any one of these components, an exposure pathway is considered incomplete and, by definition, there is no risk or hazard. Figure 7-2 presents the CEM schematic for the FCS.

Contaminant Sources and Release Mechanisms

The primary sources of contaminants and release mechanisms at FCS include those associated with former operations at the various sites. These general sources include the following:

- Spillage and leakage from storage tanks, transformers, and drums
- Substances in historical landfills
- Substances in fire training areas
- Leaking pipelines

The risk assessments evaluate the remaining chemicals that have been associated with past operations, which include POL, PCBs, pesticides, solvents, PAHs, metals, and munitions/explosive residues.

Environmental Transport Media

The plausible mechanisms transporting the COPCs from their sources, through environmental media to potential receptors, include the following (see Figure 7-2):

1. Volatilization of vapors from shallow groundwater and subsurface soil to soil-gas and indoor air
2. Dust or vapors generated from wind or mechanical erosion
3. Infiltration/percolation and leaching of contaminants to groundwater
4. Migration of shallow groundwater to the offsite deeper FWA water supply wells[5]
5. Discharge of groundwater to offsite surface water and sediment
6. Surface drainage and runoff during storm events or snowmelt

In addition to contaminant migration from the original release areas to potential exposure points, future residents, workers, or recreational visitors could directly come into contact with contaminated surface soil, and future excavation workers could come into contact with contaminated subsurface soil during excavation activities (as illustrated in the CEM in Figure 7-2).[6]

Potentially Complete Human Exposure Pathways and Receptors

On the basis of current understanding of land and water beneficial use conditions at or near the FCS, the most plausible exposure scenarios considered for characterizing human health risks include the following:

Future Maintenance Worker Scenario. Under future site conditions, workers could be exposed to surface soil during maintenance activities at the FCS. Potential routes of exposure to surface soil (0 to 2 feet bgs) for the maintenance worker would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors.

---

[5] As described in Section 2, there is no indication of contaminant migration toward the water supply wells.

[6] Any future exposures to soil will be minimized by the clean soil cover (about 2 feet bgs) that will be placed during completion of construction at the FCS and the implementation of Army Garrison policies that will be in place to preclude digging at the property.

Future Excavation Worker Scenario. Under future site conditions, excavation workers could be exposed to subsurface soil during infrequent excavation activities at the FCS. These activities could include placement or repair of utilities or other construction activities involving digging. Potential routes of exposure to subsurface soil (0 to 15 feet bgs) for the excavation worker would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors generated during excavation activities. Excavation worker contact with groundwater is not evaluated. Excavations down to the groundwater table (about 15 ft bgs) are not anticipated at the FCS because horizontal utilities at the site are not below 8 feet bgs, and are above the groundwater table. Also, any water encountered in a trench (e.g., from runoff) would generally be pumped prior to trench work for safety purposes.

Future Recreational/Site Visitor Scenario. Future recreationalists and site visitors may use common areas and open space that surrounds the residential areas. The current FCS plans indicate playground areas, a sledding hill, and an ice skating rink. For surface soil (0 to 2 feet bgs), the plausible exposure routes would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors.

Reasonably Anticipated Future Use (Residential) Scenario. Given the anticipated future uses at the FCS, residents are expected to live at the FCS. This scenario is included to provide support for Army risk management decisions for military occupation in the housing units, and includes consideration of existing restrictions that preclude digging onsite, and prevent use of groundwater from areas outside of the existing FWA water supply wells. For surface soil (0 to 2 feet bgs), the exposure routes for the future resident would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors. For soil-gas, the exposure route would be inhalation of VOC vapors emanating from shallow groundwater or subsurface soil into indoor air. Additionally, if contaminants in groundwater from the FCS were to migrate to the FWA water supply wells, exposure to contaminants in drinking water and during bathing/showering would represent complete pathways.

It is not anticipated that future gardening would represent a complete exposure scenario at the FCS because the Army Garrison policies include specific prohibition against occupants disturbing the soil deeper than 6 inches, to include growing vegetable gardens or planting large shrubs, trees, or other lawn ornaments. The low concern for this pathway is also consistent with the conclusions of the April 26, 2010, ADSTR Health Consultation for Taku Gardens (ATSDR, 2010), which states that harmful health effects are not expected for people who gardened in the community garden after 1967.

Hypothetical Future Unrestricted Exposure Scenario. This evaluates the no-action scenario and includes conservative default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media. For soil (0 to 15 feet bgs), the exposure routes for the unrestricted scenario would include incidental soil ingestion, dermal contact with soil, and inhalation of ambient dusts and vapors. For soil-gas, the exposure route would be inhalation of VOC vapors emanating from shallow groundwater or subsurface soil into indoor air. For groundwater, exposure routes would include drinking, dermal contact, and vapor inhalation during bathing/showering.

As previously mentioned, this HHRA is evaluated under two distinct sets of assumptions regarding potential future exposures at the site (as defined in the last two bullets above) to accommodate the respective needs of both ADEC regulatory requirements and the Army risk management decisions for military occupation in the housing units. When interpreting the results of the HHRA, it is critical that there be logical separation between these two evaluation approaches, and a clear understanding of the intended uses of the respective results for decision making.

Potentially Complete Ecological Exposure Pathways and Receptors

The ecoscoping forms for the FCS were presented in Appendix F of the *Preliminary Source Evaluation 1 Narrative Report Former Communications Site, Fort Wainwright, Alaska, Interim Final* (Oasis, 2007), and provided in Appendix M of this report. Based on the ecoscoping and other information obtained during the RI, plausible ecological exposure pathways considering the COPCs, available habitat, and available food sources at the FCS include the following:

- Potential exposures of aquatic resources and piscivorous (fish-eating) wildlife to chemicals in groundwater that could reach the Chena River
- Potential exposure of terrestrial wildlife (mammals and birds) to site-related chemicals in sediment from drainage swales adjacent to the FCS
- Hypothetical exposure of benthic macroinvertebrates to drainage swale sediments potentially migrating to the Chena River

Both EPA guidance (EPA, 1998) and the ADEC 2009 Ecoscoping Guidance (ADEC, 2009c) consider the quality and availability of habitat as an important factor for determining whether an ERA for onsite exposure to soil is needed. The ADEC guidance states that "industrialized or densely populated urban areas usually do not contain important habitats. Typically, most of the natural vegetation that could support wildlife has been removed" (ADEC, 2009c). Because no quality habitat exists or will exist at the site, an ERA for onsite soil is unnecessary.

7.5 Human Health Risk Assessment

This section presents the HHRA conducted for the FCS, including an analysis of the potential for adverse human health effects potentially associated with chemicals detected in environmental media at the FCS.

7.5.1 Organization of This Section

This HHRA is composed of the following components:

- **Section 7.5.2: Human Exposure Assessment**—identifies the pathways by which potential human exposures could occur, describes how they are evaluated, and evaluates the magnitude, frequency, and duration of these exposures.
- **Section 7.5.3: Human Toxicity Assessment**—summarizes the toxicity of the selected chemicals and the relationship between magnitude of exposure and the occurrence of adverse health effects.

- **Section 7.5.4: Human Health Risk Characterization**—integrates information from the exposure and toxicity assessments to characterize the risks to human health from potential exposure to chemicals in environmental media.
- **Section 7.5.5: Conclusions from the HHRA**—summarizes the HHRA and provides discussion on whether further human health investigations are warranted or if remedial actions should be evaluated.

7.5.2 Human Exposure Assessment

Potential human receptors identified in the CEM (see Figure 7-2) include future maintenance workers, future excavation workers, future recreational/site visitors, and future residents. Potentially complete exposure pathways to these receptors have been identified in the CEM. This section describes the equations and exposure assumptions that were used to calculate direct contact exposures related to ingestion of or dermal contact with contaminants in soil and groundwater, and the inhalation exposures associated with ambient dusts or vapors or with indoor vapor intrusion. In accordance with ADEC guidance (ADEC, 2004b, 2009b) exposure factors (when applicable) for the under-40-inch zone were used.

Intake Equations for Ingestion of Soil

The following equations were used to calculate the intake (expressed as milligrams per kilogram per day [mg/kg-day]) associated with the incidental ingestion of carcinogenic and noncarcinogenic contaminants in soil under the future maintenance worker, future excavation worker, and future site visitor/recreation user[7] exposure scenarios:

$$Intake = \frac{C_s \times IRS_a \times 10^{-6}\, kg/mg \times EF \times ED_a}{BW_a \times AT}$$

The following age-weighted equation was used to calculate the intake associated with the incidental ingestion of carcinogenic and noncarcinogenic contaminants in soil under both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$Intake = \frac{C_s \times IFS_{adj} \times EF \times 10^{-6}\, kg/mg}{AT}$$

where:

$$IFS_{adj} = \frac{ED_c \times IRS_c}{BW_c} + \frac{ED_a \times IRS_a}{BW_a}$$

where:

C_s = chemical concentration in soil (mg/kg)
IFS_{adj} = age-adjusted soil ingestion factor [(mg-year)/(kg-day)]
IRS_a = adult soil ingestion rate (mg/day)

[7] The site visitor/recreational user is conservatively assumed to be a 10-year-old child. See Table 7-1 for exposure factors for this scenario.

IRS_c = child soil ingestion rate (mg/day)
EF = exposure frequency (days/year)
ED_a = adult exposure duration (years)
ED_c = child exposure duration (years)
BW_a = adult body weight (kg)
BW_c = child body weight (kg)
AT = averaging time (days)

The exposure assumptions for estimating chemical intake from the ingestion of contaminants in soil are presented in Table 7-1.

Intake Equations for Dermal Contact with Soil

The following equations were used to calculate the intake from dermal contact with carcinogenic and noncarcinogenic contaminants in soil under the future maintenance worker, future excavation worker, and future site visitor/recreation user exposure scenarios:

$$Intake = \frac{C_S \times ABS \times SA_a \times AF_a \times EF \times ED_a \times 10^{-6}\, kg/mg}{BW_a \times AT}$$

The following age-weighted equation was used to calculate the intake from dermal contact with carcinogenic and noncarcinogenic contaminants in soil under both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$Intake = \frac{C_S \times SFS_{adj} \times ABS \times EF \times 10^{-6}\, kg/mg}{AT}$$

where:

$$SFS_{adj} = \frac{ED_c \times AF_c \times SA_c}{BW_c} + \frac{ED_a \times AF_a \times SA_a}{BW_a}$$

where:

C_s = chemical concentration in soil (mg/kg)
SFS_{adj} = age-adjusted dermal contact factor [(mg-year)/(kg-day)]
SA_a = adult exposed skin surface area (square centimeters [cm^2])
SA_c = child exposed skin surface area (cm^2)
AF_a = adult soil-to-skin adherence factor (mg/cm^2)
AF_c = child soil-to-skin adherence factor (mg/cm^2)
EF = exposure frequency (days/year)
ED_a = adult exposure duration (years)
ED_c = child exposure duration (years)
BW_a = adult body weight (kg)
BW_c = child body weight (kg)
AT = averaging time (days)

The exposure assumptions for estimating exposure from dermal contact with soil are presented in Table 7-1. Dermal absorption factor values were obtained from the dermal assessment guidance (EPA, 2004a).

Intake Equations for Ingestion of Groundwater

The following age-weighted equation was used to calculate the intake of carcinogenic and noncarcinogenic chemicals associated with the ingestion of groundwater under both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$Intake = \frac{C_w \times IFW_{adj} \times EF}{AT}$$

where:

$$IFW_{adj} = \frac{ED_c \times IRW_c}{BW_c} + \frac{ED_a \times IRW_a}{BW_a}$$

where:

C_W = chemical concentration in groundwater (mg/L)
IFW_{adj} = age-adjusted water ingestion factor [(L-year)/(kg-day)]
IRW_a = adult groundwater ingestion rate (L/day)
IRW_c = child groundwater ingestion rate (L/day)
EF = exposure frequency (days/year)
ED_a = adult exposure duration (years)
ED_c = child exposure duration (years)
BW_a = adult body weight (kg)
BW_c = child body weight (kg)
AT = averaging time (days)

The exposure assumptions for estimating chemical intake from the ingestion of groundwater are presented in Table 7-2.

Intake Equations for Dermal Contact with Groundwater

The following age-weighted equation was used to calculate the intake associated with dermal contact with carcinogenic and noncarcinogenic chemicals in groundwater under both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$Intake = \frac{C_w \times SFW_{adj} \times Kp \times EF \times ET \times CF}{AT}$$

where:

$$SFW_{adj} = \frac{ED_c \times SA_c}{BW_c} + \frac{ED_a \times SA_a}{BW_a}$$

where:

C_W = chemical concentration in groundwater (mg/L)
SFW_{adj} = age-adjusted water dermal contact factor [(cm^2-year)/kg]
Kp = dermal permeability coefficient (cm/hour)
EF = exposure frequency (days/year)
ET = exposure time (hour)
CF = Conversion Factor (0.001 L/cubic centimeter)
ED_a = adult exposure duration (years)
ED_c = child exposure duration (years)
SA_a = adult exposed skin surface area (cm^2)
SA_c = child exposed skin surface area (cm^2)
BW_a = adult body weight (kg)
BW_c = child body weight (kg)
AT = averaging time (days)

The exposure assumptions used to estimate exposure from dermal contact with groundwater are presented in Table 7-2. Chemical-specific dermal permeability coefficients (Kp) were obtained from the Oak Ridge National Laboratory (ORNL) Risk Assessment Information System (ORNL, 2009). ORNL provides Kp values calculated using the EPA's Dermwin™ tool, which is a program that estimates the Kp.

Equation for Inhalation of Ambient Dusts or Vapors

The following equation was used to calculate the exposure concentration of carcinogenic and noncarcinogenic contaminants associated with inhalation of ambient vapor or dust emissions from soil under the future maintenance worker, future excavation worker, future site visitor/recreation user, reasonably anticipated future use (residential), and hypothetical unrestricted exposure scenarios:

$$EC = \frac{C_s \times \left(\frac{1}{PEF} + \frac{1}{VF} \right) \times EF \times ED}{AT}$$

where:

EC = inhalation exposure concentration (mg/m^3)
C_s = chemical concentration in soil (mg/kg)
EF = exposure frequency (days/year)
ED = exposure duration (years)
PEF = particulate emission factor (m^3/kg)
VF = volatilization factor (m^3/kg)
AT = averaging time (days)

The volatilization factors (VF) for VOCs identified as COPCs in soil are calculated using the Jury Model presented in the soil screening guidance (EPA, 1996). The exposure assumptions used to estimate exposure from inhalation of dust and vapors in ambient air are presented in Table 7-1, and VFs are provided in Table 7-2.

Equation for Inhalation of Vapors in Groundwater

The following equation was used to calculate the exposure concentration of carcinogenic and noncarcinogenic contaminants associated with inhalation of vapors from showering or other household activities under both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$EC = \frac{C_w \times VF \times EF \times ED}{AT}$$

where:

EC = inhalation exposure concentration (mg/m^3)
C_w = chemical concentration in water (mg/L)
EF = exposure frequency (days/year)
ED = exposure duration (years)
VF = Volatilization factor (L/m^3) (Andelman, 1990)
AT = averaging time (days)

The exposure assumptions used to estimate exposures from inhalation of volatile chemicals are listed Table 7-2. Volatile chemicals considered for the inhalation pathway are operationally defined as those COPCs with a Henry's Law constant greater than 10^{-5} atm-m^3/mole (atmospheres-meters cubed per mole) and a molecular weight of less than 200 grams per mole (EPA, 1991a).

Inhalation Intake Equations for Inhalation of Soil-Gas Migrating into Indoor Air

In addition to addressing exposure from inhalation of ambient air, COPC concentrations in subslab soil gas were used to evaluate the potential for migration of volatile contaminants into indoor air at each residential housing unit. The following equation is used to calculate the exposure concentration associated with the inhalation of vapors emanating from subslab soil-gas and migrating into indoor air for both the reasonably anticipated future use (residential) and hypothetical unrestricted exposure scenarios:

$$EC = \frac{C_{SG} \times ATF_{res} \times EF \times ED}{AT}$$

where:

EC = inhalation exposure concentration (µg/m^3)
C_{SG} = chemical concentration in subslab soil-gas (µg/m^3)
ATF_{res} = soil-gas to residential indoor air attenuation factor (unitless)
EF = exposure frequency (days/year)
ED = exposure duration (years)
AT = averaging time (days)

For this HHRA, a site-specific attenuation factor was derived by measuring levels of radon in subslab soil-gas and in corresponding indoor air within 19 of the living units (representing five different home styles) present at the FCS (McHugh et al., 2008). The details of the radon sampling and analytical results, as well as comparative results for site-related VOCs are provided in Appendix N. The site-specific attenuation factor identified was 0.0022, conservatively selected as the upper 95th percent UCL of the results from 19 locations measured.

Calculation of Intake for Mutagenic COPCs

If a chemical has been determined to cause cancer by a mutagenic mode of action (MOA), EPA has noted that it is possible that exposures to that chemical in early-life could result in higher lifetime cancer risks than a comparable duration adult exposure (EPA, 2009). In assessing the risk for which a mutagenic MOA has been identified by EPA, default age-dependent adjustment factors (ADAF) are applied. The *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, 2005a) recommends the following default ADAFs:

- Tenfold adjustment for exposures during the first 2 years of life
- Threefold adjustment for exposures from ages 2 to less than 16 years of age
- No adjustment for exposures after turning 16 years of age

These ADAFs are used to prorate the toxicity factors for the respective age ranges, to account for more or less sensitivity during that life stage. For example, there is assumed by default to be tenfold greater sensitivity over the first 2 years of life than for an equivalent level of exposure after turning 16 years of age. For the FCS, consideration of early-life stage exposure was limited to the site visitor/recreation user, reasonably anticipated future use (residential), and hypothetical unrestricted exposure scenarios.

Potential Exposure to Petroleum, Oils, and Lubricants

In accordance with the ADEC (2008b) publication, "Oil and Other Hazardous Substances Pollution Control," maximum surface and subsurface soil concentrations for petroleum hydrocarbons were compared with Method 2 petroleum cleanup levels (Table B2 of ADEC [2008b]). The Method 2 values used were those representative of a site that receives mean annual precipitation of less than 40 inches each year (Under 40-Inch Zone). The results of the comparison are as follows:

- Of the 5 surface soil (0 to 2 feet bgs) samples where GRO was analyzed, the maximum concentration was 850 mg/kg (07FW-A-EXBld48-41), which is below the Method 2 soil cleanup levels for ingestion and inhalation of 1,400 mg/kg.

- Of the 128 surface soil (0 to 2 feet bgs) samples where DRO was analyzed, the maximum concentration was 360 mg/kg (08-FW-C-EXBLD01-09-2), which is well below the Method 2 soil cleanup level for ingestion of 10,250 mg/kg.

- Of the 153 surface soil (0 to 2 feet bgs) samples where RRO was analyzed, the maximum concentration was 860 mg/kg (08-FW-D-EXREAD-05-0_2), which is well below the Method 2 soil cleanup level for ingestion of 10,000 mg/kg.

- Of the 37 subsurface soil (0 to 15 feet bgs) samples where GRO was analyzed, the maximum concentration was 630 mg/kg (07FW-A-EXBld48-43), which is below the Method 2 soil cleanup level for ingestion of 1,400 mg/kg.

- Of the 374 subsurface soil (0 to 15 feet bgs) samples where DRO was analyzed, the maximum concentration was 13,000 mg/kg (06SI31SO), which is slightly above the Method 2 soil cleanup level for ingestion of 10,250 mg/kg. Only 1 of 374 samples analyzed for DRO exceeded the Method 2 soil cleanup level for ingestion. Of the remaining 373 samples, none contained a DRO concentration greater than 5,000 mg/kg. The one exceedance occurred at a depth of 12 feet bgs, where the only plausible exposure would be to an excavation worker during a short-term digging event.

- Of the 407 subsurface soil (0 to 15 feet bgs) samples where RRO was analyzed, the maximum concentration was 3,500 mg/kg (08-FW-D-EXREAD-11-2_4), which is well below the Method 2 soil cleanup level for ingestion of 10,000 mg/kg.

As a result, risk from exposure to detected petroleum mixtures at the FCS is considered within the acceptable regulatory levels. Risk from individual chemicals potentially occurring as a result of petroleum contamination (such as BTEX and PAHs) were addressed using the methodologies described in the previous sections.

7.5.3 Human Toxicity Assessment

The toxicity assessment section of the HHRA identifies the types of toxic effects a chemical can exert. Chemicals were divided into two broad groups on the basis of their effects on human health: noncarcinogens and carcinogens. This classification has been selected because health risks are calculated quite differently for carcinogenic and noncarcinogenic effects, and separate toxicity values have been developed for them.

Carcinogens are those chemicals suspected of causing cancer following exposure; noncarcinogenic effects cover a wide variety of systemic effects, such as liver toxicity or developmental effects. Some chemicals (such as benzene and PCBs) are capable of eliciting both carcinogenic and noncarcinogenic responses; therefore, these carcinogens are also evaluated for systemic (noncarcinogenic) effects.

For cancer effects, EPA developed a carcinogen classification system (EPA, 1986) that used a weight-of-evidence approach to classify the likelihood that a chemical is a human carcinogen. Although this classification scheme has been superseded in more recent guidance, the *Guidelines for Carcinogen Risk Assessment* (EPA, 2005b), it is still referred to by EPA and is used in this updated HHRA. Information considered in developing the classification includes human studies of the association between cancer incidence and exposure, as well as long-term animal studies under controlled laboratory conditions. Other supporting evidence considered includes short-term tests for genotoxicity, metabolic and pharmacokinetic properties, toxicological effects other than cancer, structure-activity relationships, and physical and chemical properties of the chemical. For noncancer effects, toxicity values were derived on the basis of the critical toxic endpoint (that is, the most sensitive adverse effect following exposure). Carcinogens are classified by EPA as known (Group A), probable (Groups B1 and B2), or possible (Group C) human carcinogens. The EPA weight-of-evidence classification system for carcinogenicity is shown in Table 7-3.

Reference Doses for Noncancer Effects

The toxicity value describing the dose-response relationship for noncancer effects is the reference dose value (RfD), or in the case of inhalation, the reference concentration, or RfC. For noncarcinogenic effects, the body’s protective mechanisms must be overcome before an adverse effect is manifested. If exposure is high enough and these protective mechanisms (or thresholds) are exceeded, adverse health effects can occur. EPA attempts to identify the upper bound of this tolerance range in the development of noncancer toxicity values. EPA uses the apparent toxic threshold value, in conjunction with uncertainty factors based on the strength of the toxicological evidence, to derive an RfD or RfC. EPA defines an RfD (also applies to RfC) as follows (EPA, 1989):

> In general, the RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is generally expressed in units of mg/kg of body weight each day (mg/kg-day).

The FCS HHRA uses available chronic RfDs and RfCs for the oral and inhalation exposure routes, respectively. Because EPA has not derived toxicity values specific to skin contact, dermal RfDs were derived in accordance with the EPA (EPA, 2004c). The RfD that reflects the absorbed dose was calculated by using the following equation:

$$RfD_{ABS} = RfD_o \times ABS_{GI}$$

where:

RfD_{ABS} = absorbed reference dose
RfD_o = oral reference dose
ABS_{GI} = gastrointestinal (GI) absorption efficiencies

GI absorption efficiencies were obtained from the *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a).

Slope Factors for Cancer Effects

The dose-response relationship for cancer effects is expressed as a cancer slope factor that converts estimated intake directly to excess lifetime cancer risk (ELCR). Slope factors are presented in units of risk per level of exposure (or intake). The data used to estimate the dose-response relationship are taken from lifetime animal studies or human occupational or epidemiological studies in which excess cancer risk has been associated with exposure to the chemical. However, because risk at low intake levels cannot be directly measured in animal or human epidemiological studies, a number of mathematical models and procedures have been developed to extrapolate from the high doses used in the studies to the low doses typically associated with environmental exposures. The model choice leads to uncertainty. EPA generally assumes linearity at low doses and uses the linearized multistage procedure when uncertainty exists about the mechanism of action of a carcinogen and when information suggesting nonlinearity is absent.

It is assumed, therefore, that if a cancer response occurs at the dose levels used in the studies, there is some probability that a response will occur at all lower exposure levels (that is, a dose-response relationship with no threshold is assumed). Moreover, the dose-response slope chosen is usually the UCL on the dose-response curve observed in the laboratory studies. As a result, uncertainty and conservatism are built into the EPA risk extrapolation approach. EPA has stated that cancer risks estimated by this method produce estimates that "provide a rough but plausible upper limit of risk." In other words, it is not likely that the true risk would be much more than the estimated risk, but "the true value of the risk is unknown and may be as low as zero" (EPA, 1986).

Because EPA has not derived toxicity values specific to skin contact, dermal slope factors were derived in accordance with the EPA *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a). The slope factor that reflects the absorbed dose was calculated by using the following equation:

$$SF_{ABS} = \frac{SF_o}{ABS_{GI}}$$

where:

SF_{ABS} = absorbed slope factor
SF_o = oral slope factor
ABS_{GI} = GI absorption efficiencies

GI absorption efficiencies were obtained from the *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004a).

For the inhalation route, this HHRA uses the inhalation unit risk (IUR) to estimate risk in accordance with *Risk Assessment Guidance for SuperfundVolume I: Human Health Evaluation Manual Part F, Supplemental Guidance for Inhalation Risk Assessment* (EPA, 2009b). EPA defines an IUR as "the upper-bound [ELCR] estimated to result from continuous exposure to an agent at a concentration of 1 µg/m^3 in air" (EPA, 2008a).

Source of Toxicity Values

In accordance with EPA guidance (2003), the toxicity values (cancer slope factors and noncancer reference doses) used were obtained from the following sources:

- The Integrated Risk Information System (IRIS) database available through the EPA Environmental Criteria and Assessments Office in Cincinnati, Ohio. IRIS, prepared and maintained by EPA, is an electronic database containing health risk and EPA regulatory information on specific chemicals.
- EPA provisional peer-reviewed toxicity values (PPRTV), provided by the Office of Research and Development, National Center for Environmental Assessment, Superfund Health Risk Technical Support Center, which develops these values on a chemical-specific basis when requested under the EPA Superfund program.
- Other toxicity values such as those from CalEPA, ATSDR minimal risk levels, or HEAST, provided by the EPA Office of Solid Waste and Emergency Response (EPA, 1997c). HEAST is a compilation of toxicity values published in various health effects documents issued by EPA.

The toxicity values used in the HHRA are listed in Table 7-4 and, following the above hierarchy, were obtained from EPA RSL tables (EPA, 2009a).

One exception for which toxicity values were not obtained from the RSL tables was TCE. Instead, the oral slope factor and IUR for TCE were obtained from ADEC cleanup levels calculation sheets, as requested by ADEC. For cases where risk estimates were found to be contributed by TCE using the ADEC toxicity factors, a corresponding risk was estimated using the draft oral slope factor and IUR currently proposed by EPA (EPA, 2009b). These side-by-side risk estimates are included to allow risk managers to make the most informed risk management decisions, considering the most current understanding of the toxicology of TCE. The uncertainty of use of the ADEC TCE cancer toxicity factors is discussed in the uncertainties section (see Section 7.7).

7.5.4 Human Health Risk Characterization

This section summarizes the approach used to develop the human health risk estimates for the FCS and presents a quantitative risk characterization for the soil, subslab soil-gas, and groundwater samples used in the HHRA. In this risk characterization step, quantification of risk is accomplished by combining the results of the exposure assessment (estimated chemical intakes) with the results of the dose-response assessment (toxicity values identified in the toxicity assessment) to provide numerical estimates of potential human health effects. The quantification approach differs for potential cancer and noncancer effects, as described in the following sections.

Although the HHRA produced numerical estimates of risk, it should be recognized that these numbers might not predict actual health outcomes because they are based largely on hypothetical assumptions. Their purpose is to provide a frame of reference for risk management decision making. Any actual risks are likely to be lower than these estimates, and may even be zero. Interpretation of the risk estimates provided should consider the nature and weight of evidence supporting these estimates, as well as the magnitude of uncertainty surrounding them.

For the purposes of this evaluation, the potential for unacceptable human health risk is identified by using the following risk thresholds:

In interpreting estimates of excess lifetime cancer risks, EPA under the Superfund program generally considers action to be warranted when the multichemical aggregate cancer risk for all exposure routes within a specific exposure scenario exceeds 1×10^{-4}. Action generally is not required for risks falling within 1×10^{-6} and 1×10^{-4}; however, this is judged on a case-by-case basis (EPA, 1991b). Under state guidance, ADEC considers a cancer risk exceeding 1×10^{-5} as unacceptable risk.

- Under both EPA and state guidance, unacceptable noncancer hazard exists if the multichemical aggregate noncancer hazard for all exposure routes within a specific exposure scenario exceeds a target noncancer HI of 1.
- If lead concentrations in environmental media result in a predicted blood-lead level of 10 micrograms per deciliter (µg/dL) in greater than 5 percent of the potentially exposed population,[8] lead is present at unacceptable levels.

Cancer Risk Estimation Method

The potential for cancer effects is evaluated by estimating ELCR. This risk is the incremental increase in the probability of developing cancer during one's lifetime in addition to the background probability of developing cancer (that is, if no exposure to FCS chemicals

[8] For the purposes of this HHRA, soil and groundwater concentrations equal to the ADEC Table B1 and Table C were used as threshold levels. These concentrations meet the threshold of 10 µg/dL blood-lead level in greater than 5 percent of the potentially exposed population.

occurs). For example, an ELCR of 2×10^{-6} means that, for every 1 million people exposed to the carcinogen throughout their lifetimes, the average incidence of cancer could increase by two cases of cancer. In the United States, the background probability of developing cancer for men is a little less than one in two and, for women, is a little more than one in three (American Cancer Society, 2003). As previously mentioned, cancer slope factors developed by EPA represent upper-bound estimates; therefore, any cancer risks generated in this assessment should be regarded as an upper bound on the potential cancer risks rather than accurate representations of true cancer risk. The true cancer risk is likely to be less than that predicted (EPA, 1989). For the FCS, ELCR was estimated by using the following formula:

$$Risk = Intake \times SF$$

where:

Risk = ELCR (unitless probability)
Intake = chronic daily intake averaged over a lifetime (mg/kg-day)
SF = cancer slope factor $(mg/kg\text{-}day)^{-1}$

Inhalation risk is calculated by multiplying intake by the IUR. The IUR is expressed in different units than the cancer slope factor (above), and a conversion factor is needed to normalize units between the IUR and intake values. Inhalation risk is estimated by using the following formula:

$$Risk_{inh} = Intake_{inh} \times IUR \times CF$$

where:

$Risk_{inh}$ = ELCR from inhalation (unitless probability)
$Intake_{inh}$ = Chronic inhalation intake averaged over a lifetime (mg/m^3)
IUR = Inhalation unit risk $(\mu g/m^3)^{-1}$
CF = Conversion factor (µg/mg)

Although synergistic or antagonistic interactions might occur between cancer-causing chemicals and other chemicals, information is generally lacking in the toxicological literature to predict quantitatively the effects of these potential interactions. Therefore, cancer risks are treated as additive within an exposure route in this assessment. This approach is consistent with the EPA guidelines on chemical mixtures (EPA, 1986). For estimating the cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation is used:

$$Risk_T = \sum_1^N Risk_i$$

where:

$Risk_T$ = total cancer risk from route of exposure
$Risk_i$ = cancer risk for the i^{th} chemical
N = number of chemicals

Noncancer Risk Estimation Method

For noncancer effects, the likelihood that a receptor will develop an adverse effect is estimated by comparing the predicted level of exposure for a particular chemical with the highest level of exposure that is considered protective (that is, its RfD). The ratio of the intake divided by RfD is termed the hazard quotient (HQ):

$$HQ = Intake / RfD$$

where:

HQ = noncancer hazard quotient from route of exposure
Intake = chronic daily intake averaged over the exposure duration (mg/kg-day)
RfD = noncancer reference dose (mg/kg-day)

For noncancer effects by inhalation exposure, the following equation is used:

$$HQ_{inh} = Intake / RfC$$

where:

HQ_{inh} = Noncancer hazard quotient from inhalation
$Intake_{inh}$ = Chronic inhalation intake averaged over the exposure duration (mg/m^3)
RfC = Noncancer reference concentration (mg/m^3)

When the HQ for a chemical exceeds one (that is, exposure exceeds RfD or RfC), there is a concern for potential noncancer health effects. To assess the potential for noncancer effects posed by exposure to multiple chemicals, an HI approach was used according to EPA (1989) guidance. This approach assumes that the noncancer hazard associated with exposure to more than one chemical is additive; therefore, synergistic or antagonistic interactions between chemicals are not accounted for. The HI may exceed 1.0 even if all the individual HQs are less than 1. In this case, the chemicals may be segregated by similar mechanisms of toxicity and toxicological effects. Separate HIs may then be derived based on mechanism and effect. The HI is calculated as follows:

$$HI = \frac{Intake_1}{RfD_1} + \frac{Intake_2}{RfD_2} + \ldots \frac{Intake_i}{RfD_i}$$

where:

HI = hazard index
$Intake_i$ = daily intake of the *i*th chemical (mg/kg-day)
RfD_i = reference dose of the *i*th chemical (mg/kg-day)

Both intake and RfD are expressed in the same units (mg/kg-day) and represent the same exposure period (that is, chronic exposure).

Risk Estimation Method for Lead

Potential risks from lead concentrations were evaluated by using different methods than those conventionally used for other carcinogens and noncarcinogens. For direct contact pathways, the concentrations of lead in soil were compared with the ADEC Table B1 value of 400 mg/kg for residential land use and 800 mg/kg for worker exposures. The concentrations of lead in groundwater were compared with the ADEC Table C value and EPA drinking water action level of 0.015 mg/L.

The comparison values for residential land use were derived by using the Integrated Exposure Uptake Biokinetic (IEUBK) Lead Model (EPA, 2004c). The IEUBK model is designed to predict probable blood-lead concentrations for children between 6 months and 7 years of age who have been exposed to lead through various sources (e.g., air, water, soil, dust, and in utero contributions from the mother). A predicted blood-lead level of 10 µg/dL in greater than 5 percent of the potentially exposed population is considered a level of concern that triggers intervention to reduce exposure. The soil comparison value for worker scenarios was derived based on EPA's adult lead model (EPA, 2003). The adult lead model develops a risk-based soil concentration that is protective of fetuses carried by women who may be exposed to lead in soil.

Summary of Risk Estimates by Exposure Scenario

This section summarizes the risk estimates for each of the exposure scenarios identified for the FCS. As described on the CSM, the exposure scenarios for the FCS are as follows:

- Future maintenance worker scenario
- Future excavation worker scenario
- Future recreational/site visitor scenario
- Reasonably anticipated future use (residential) scenario
- Hypothetical unrestricted exposure scenario

The cancer and noncancer risk estimates for soil, subslab soil-gas, and groundwater, under future conditions, are summarized by exposure scenario in the following sections. The COPCs identified for each medium include all detected chemicals with available toxicity factors (unless demonstrated to be less than natural background, such as arsenic in soil and a few metals in groundwater). For each potentially exposed population, risk estimates are provided for individual exposure routes, as well as cumulative risks across all exposure routes. For the residential exposure scenario, for which exposure to more than one environmental medium can occur, multimedia risk estimates are also provided. The risk calculation data sheets used to develop the risk summary tables for each exposure scenario described below are provided by scenario in Appendix M.[9]

Future Maintenance Worker Scenario. Potential exposures to surface soil (0 to 2 feet bgs) were evaluated under this scenario. Potential routes of exposure to COPCs in surface soil include incidental ingestion, dermal contact, and inhalation of ambient dusts and vapors. The future maintenance worker was assumed to be a 70-kg adult exposed to surface soil anywhere across the FCS for 250 days per year over a duration of 6.6 years (mean work tenure, according to EPA [1997d]).

A conservative screening approach was used to select exposure concentrations for the future maintenance worker scenario, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though

[9] Chemicals listed with zero intake in the risk calculations tables provided in Appendix M were not detected in that specific sample or data grouping, but are included as a matter of book-keeping so that all samples analyzed could be documented.

maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary for this scenario. A total of 347 surface soil samples (shown on Figures 3-5 and 3-6) were used for the future maintenance worker scenario risk evaluation.

The HI and ELCR estimates for the maintenance worker exposure scenario are summarized in Table 7-5. The maximum HI for noncarcinogenic chemicals in surface soil is 0.5 for this scenario, which is below the EPA and ADEC threshold value of 1. The maximum ELCR from all carcinogenic chemicals in surface soil is 3×10^{-6}, which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. The risk calculation data sheets for the maintenance worker exposure scenario are provided in Appendix M, Table M-5.

The maximum concentration of lead in surface soil (254 mg/kg) for this exposure scenario does not exceed the ADEC Table B1 value of 800 mg/kg for industrial land use.

Future Excavation Worker Scenario. Potential exposures to subsurface soil (0 to 15 feet bgs) were evaluated under this scenario. Potential routes of exposure to COPCs in subsurface soil include incidental ingestion, dermal contact, and inhalation of ambient dusts and vapors. The future excavation worker was assumed to be a 70-kg adult exposed to subsurface soil anywhere across the FCS for 20 days per year (4 work weeks) over a duration of 6.6 years (mean work tenure, according to EPA [1997d]).

A conservative screening approach was used to select exposure concentrations for the future excavation worker scenario, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary for this scenario. A total of 1,500 subsurface soil samples from 0 to 15 ft bgs were used for the future excavation worker scenario risk evaluation.

The HI and ELCR estimates for the excavation worker exposure scenario are summarized in Table 7-5. The maximum HI for noncarcinogenic chemicals in subsurface soil is 0.7 for this scenario, which is below the EPA and ADEC threshold value of 1. The maximum ELCR from all carcinogenic chemicals in subsurface soil is 2×10^{-6}, which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. The risk calculation data sheets for the excavation worker exposure scenario are provided in Appendix M, Table M-6.

The maximum concentration of lead in subsurface soil (289 mg/kg) for this exposure scenario does not exceed the ADEC Table B1 value of 800 mg/kg for industrial land use.

Future Recreational/Site Visitor Scenario. Potential exposures to surface soil (0 to 2 feet bgs) were evaluated under this scenario. Potential routes of exposure to COPCs in surface soil include incidental ingestion, dermal contact, and inhalation of ambient dusts and vapors. The future recreational/site visitor was assumed to be a 36-kg child (10 years old) exposed to surface soil anywhere across the FCS for 28 days per year (1 day per week, 7 months per year) over a duration of 8 years (assumed reasonable maximum residence time at Fort Wainwright).

A conservative screening approach was used to select exposure concentrations for the future recreational/site visitor scenario, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary for this scenario. A total of 347 surface soil samples were used for the future recreational/site visitor scenario risk evaluation.

The HI and ELCR estimates for the future recreational/site visitor exposure scenario are summarized in Table 7-5. The maximum HI for noncarcinogenic chemicals in surface soil is 0.2 for this scenario, which is below the EPA and ADEC threshold value of 1. The maximum ELCR from all carcinogenic chemicals in surface soil is 3×10^{-6}, which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and the ADEC risk threshold of 1×10^{-5}. The risk calculation data sheets for the future recreational/site visitor exposure scenario are provided in Appendix M, Table M-7.

The maximum concentration of lead in surface soil (254 mg/kg) for this exposure scenario does not exceed the ADEC Table B1 value of 400 mg/kg for residential land use.

Reasonably Anticipated Future Use (Residential) Scenario. Future residents living at the FCS were evaluated for potential exposure to COPCs detected in the following three exposure media:

- Surface soil (0 to 2 feet bgs)
- Soil-gas potentially migrating to indoor air
- FWA supply groundwater currently used for domestic purposes

The risk and hazard estimates for each of these media exposures are described in the following sections. The cumulative multimedia risk and hazard estimates for the reasonably anticipated future use (residential) scenario, calculated as the sum of the risks and hazards for each exposure medium, are also described.

Direct Contact with Surface Soil. Potential routes of residential exposure to COPCs in surface soil include incidental ingestion, dermal contact, and inhalation of ambient dusts and vapors (collectively referred to as "direct contact with soil"). The future resident was assumed to be exposed for 350 days per year over a duration of 30 years[10] (for the first 6 years as a 15-kg child, followed by 24 years as a 70-kg adult).

Because of the history of investigations and removal actions completed at the FCS, soil sampling strategies have been both judgmental and systematic across the site. Judgmental samples were collected, for example, as confirmation samples at targeted drum and debris removal areas where geophysical anomalies were observed and at known or suspected hot spot areas. Systematic sampling was also conducted specifically to gain even coverage (for example, the 79 supplemental surface soil samples collected during the RI in October 2008) and to improve the areal and multichemical representation across the site, allowing for more comprehensive assessment of potential human health risks. As a result of these sampling

---

[10] This EPA default assumption is considered conservative for the FCS because the maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years.

approaches, surface soil sampling coverage has been roughly even across the entire FCS, as shown in Figure 3-5. In addition, the density and number of samples of available data provides some confidence that existing spatial heterogeneity has been captured in the existing sampling results. A total of 347 surface soil samples were used for the residential scenario risk evaluation. The samples used for the residential scenario are listed in Appendix M, Table M-1, and the sample-specific risk calculation data sheets for surface soil are provided as a separate subsection in Appendix M.

A conservative, sample-specific, risk evaluation approach is used to evaluate potential exposure to surface soil for the future residential exposure scenario. This is considered a screening-level approach because long-term exposure (30-year duration) is assumed to occur at each individual sample location. In reality, exposure would be spatially integrated over a much larger area than represented by a single sample location. This conservatism and other health-conservative factors that influence the interpretation of the risk evaluation for surface soil are described in the uncertainty section (see Section 7.7). Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary for this exposure scenario.

The sample-specific HI and ELCR estimates for the future residential exposure scenario are summarized in Table 7-6. The estimated HIs for noncarcinogenic chemicals in surface soil samples range from less than 0.001 to a maximum of 0.5 (at location 07FWCDSS01-01) for this scenario, which is below the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals in surface soil samples ranges from 2×10^{-10} to a maximum of 8×10^{-6} (at location 08-FW-A-EXBLD22-23-0_5), which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. Of the 347 samples with detected COPCs, 27 samples had risk estimates exceeding 1×10^{-6}.

The maximum concentration of lead in surface soil (254 mg/kg) for this exposure scenario does not exceed the ADEC Table B1 value of 400 mg/kg for residential land use.

Inhalation of Indoor Air. The possibility of inhalation exposure to COPCs in indoor air potentially originating from soil-gas was evaluated under the reasonably anticipated future use (residential) scenario. The future resident was assumed to be exposed for 350 days per year over a duration of 30 years[11] (for the first 6 years as a 15-kg child, followed by 24 years as a 70-kg adult).

For the indoor air pathway, each of the 110 residential units present at the FCS was evaluated independently, and corresponding risk and hazard estimates were quantified and are reported for each unit. Because of the relatively even spacing of the 55 buildings across the FCS, the results are expected to provide adequate spatial representation of the FCS as a whole. In addition, because each building contains two units per building foundation, these results provide two subslab sample results for each foundation (one from beneath the garage at each end). This duplication and the total number of samples are anticipated to capture spatial variability across the site. The purpose of the August 2009 sampling event was to collect additional subslab VOC samples to evaluate temporal variability, at the request of ADEC. These results, when considered collectively with the December 2008

[11] This EPA default assumption is considered conservative for the FCS because the reasonable maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years.

results, account for any temporal variability across the site. During both the December 2008 and August 2009 sampling events, the heating and ventilation systems in each home were set to simulate typical living conditions (units were generally around 68°F at the time of sampling). As a result, the data are anticipated to represent reasonably anticipated future use (residential) conditions. The sampling locations are shown on Figure 3-1. Samples used for the residential scenario are listed in Appendix M, Table M-3.

The approach for evaluating vapor intrusion of VOCs into indoor air at the FCS is consistent with the tiered process recommended in EPA Vapor Intrusion Guidance (EPA, 2002) and ADEC Draft VI Guidance (ADEC, 2009a). Moreover, it should be recognized that attribution of chemicals in indoor air to vapor intrusion can sometimes be a relatively complex and difficult task. Regulatory guidance recommends that the vapor intrusion pathway be evaluated using multiple lines of evidence to develop decisions that are based on professional judgment (EPA, 2002; ADEC, 2009a; ITRC, 2007). The results of the tiered process and the supporting lines of evidence are further described in Appendix N. The tiers of evaluation included the following:

- **Tier 1:** The first tier identified the presence of a potentially complete exposure pathway as part of the CSM, including documenting the presence of compounds that are considered sufficiently volatile and toxic, and the presence of buildings where exposure could occur. The results of the Fall 2006 PSE II provided the first indication that a vapor intrusion pathway could exist at the FCS, and was the initial basis for more focused investigations to collect active soil-gas data that could be used to estimate the potential for indoor exposure.

- **Tier 2:** The second tier determined whether concentrations detected at FCS were high enough to indicate that a more detailed site-specific evaluation was needed. This tier consisted of comparing available soil-gas data against conservative screening levels. The 2007 RI data resulting from sampling of subslab soil-gas for all 110 housing units and 53 vadose zone soil-gas locations were screening against conservative project screening levels and results were presented in the April 2008 PRSE report (CH2M HILL, 2008b). Those results indicated that the data available at that time exceeded existing PSLs. Subsequent sample concentrations have also been determined to exceed ADEC residential target levels for subslab soil-gas listed in Appendix E of the ADEC (2009a) VI draft guidance (see Appendix N). In addition to exceeding screening levels, there were several analytical issues that represented a serious enough uncertainty that precluded reliable estimation of indoor air risks. As a result, more careful site-specific investigations of the vapor intrusion pathway at the FCS were planned and conducted.

- **Tier 3:** The third tier includes site-specific investigations to address data gaps and issues previously identified during Tiers 1 and 2 as requiring refinements. Comprehensive sampling was conducted at all housing units during December 2008, and at one unit per building in August 2009, using the best available analytical methods and most representative exposure conditions. These data are the focus of this HHRA. Also, investigations into site-specific attenuation factors were completed to address limitations associated with the relatively low source strength of the VOC concentrations detected in subslab soil-gas.

A critical factor for estimating indoor air concentrations from levels detected in subslab soil-gas is the soil-gas-to-indoor-air attenuation factor. For this HHRA, a site-specific attenuation factor was derived by measuring levels of radon in subslab soil-gas and in corresponding indoor air within 19 of the living units (representing five different home styles) present at the FCS (McHugh et al., 2008). The results of the radon sampling are summarized in Appendix N, Table N-1. The details of the radon sampling and analytical results, as well as comparative results for site-related VOCs, are provided in Appendix N. The site-specific attenuation factor identified was 0.0022, conservatively selected as the 95 UCL of sample results from 19 locations measured during the RI.

The location-specific HI and ELCR estimates for vapor intrusion under the future residential exposure scenario are summarized in Table 7-7. The estimated HIs for noncarcinogenic chemicals in subslab soil-gas samples range from less than 0.001 to a maximum of 0.05 for this scenario, which is below the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals in subslab soil-gas samples ranges from 2×10^{-8} to a maximum of 6×10^{-6} (4×10^{-6} when using the draft EPA slope factor for TCE), which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. These risk estimates are considered conservative because of the inclusion of all VOCs detected in soil-gas, regardless of whether these levels could be consistent with (and possibly attributed by) levels detected in ambient background (see section titled, Inhalation of Ambient Background Air). The risk calculation data sheets for the 110 sample locations are provided as a separate subsection in Appendix M.

Inhalation of Ambient Background Air. To provide some indication of the potential confounding influences from ambient air sources (that is, offsite anthropogenic sources), ambient air samples were also collected from each of two outdoor sampling locations (one at the east fence and one at the west fence). A total of 12 ambient air samples were collected throughout the course of the RI. The HI and ELCR estimates for ambient air under the residential exposure scenario are summarized in Table 7-8. The estimated HIs for noncarcinogenic chemicals in ambient air samples range from 0.002 to a maximum of 1, which does not exceed the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals in ambient air samples ranges from 1×10^{-6} to a maximum of 5×10^{-5}, which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} and above the ADEC risk threshold of 1×10^{-5}. These results indicate that for some VOCs detected in both ambient air and subslab soil-gas at the FCS, comparable or even somewhat higher levels were found in ambient air. The potential contribution of ambient sources on measured subslab levels, however, was not accounted for (subtracted from) in the cumulative risk estimates for soil-gas reported in Table 7-7. The risk calculation data sheets for the 10 ambient air samples are provided as a separate subsection in Appendix M.

The uncertainties associated with the indoor air risk analysis are discussed in Section 7.7.

Domestic Use of Offsite FWA Supply Well Groundwater. Potential routes of exposure to COPCs in domestic groundwater include ingestion, dermal contact, and inhalation of vapors during bathing/showering. The future resident was assumed to be exposed for 350 days per year over a duration of 30 years[12] (for the first 6 years as a 15-kg child, followed by 24 years as a 70-kg adult).

As described in Section 4, two capture zones were modeled for the FWA water supply wells in Building 3559 to provide hypothetical bounding estimates on potential water use: one for the lower end of the anticipated future pumping rate (1,000 gpm) and one for the high-end of the range (1,700 gpm). These values bracket the actual (as evidenced by data records from 2005-2010) long-term production rate of 1,327 gpm, as described in Section 2.1.5. Risk estimates are provided for each of the wells within these zones. However, based on passive soil-gas sample data and groundwater data for monitoring wells installed between the FCS and the water supply wells, there is no indication of contaminant migration toward the water supply wells. Therefore, the exposure and risk estimates for the supply well itself are considered most representative of current and anticipated future groundwater uses at the FCS. Risk estimates for wells outside the capture zone are provided under the hypothetical unrestricted scenario.

The following wells were included in the evaluation of domestic use of offsite FWA supply well groundwater:

Within the hypothetical lower-end capture zone defined by current pumping of 1,000 gpm:

- Building 3559 (FWA supply wells)
- MW78
- MW85
- MW86
- MW87
- MW88
- MW89
- MW90

Within the hypothetical high-end 1,700-gpm capture zone (but outside the 1,000-gpm zone):

- MW08
- MW39
- MW47
- MW79

The FWA water supply wells were sampled to provide the most direct exposure point estimate for the HHRA. This sample was collected as raw water, prior to the normal treatment process. Moreover, as described in Section 2, there is no indication of contaminant migration toward the water supply wells.

The HI and ELCR estimates for domestic groundwater use under the reasonably anticipated future use (residential) scenario are summarized in Table 7-9. For the wells within the hypothetical lower-end 1,000-gpm capture zone, the estimated HIs for noncarcinogenic chemicals range to a maximum of 0.02, which does not exceed the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals ranges to a maximum of

[12] This EPA default assumption is considered conservative for the FCS because the reasonable maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years.

1×10^{-6} (at well MW78), at the low end of the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}.

For the wells within the hypothetical high-end 1,700-gpm capture zone but outside the 1,000-gpm zone, the estimated HIs for noncarcinogenic chemicals range from 0.4 to a maximum of 2 (in well MW79 because of 1,2,3-trichloropropane), which exceeds the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals in groundwater samples ranges to a maximum of 2×10^{-3} (at well MW79), which exceeds the EPA target risk range of 1×10^{-6} to 1×10^{-4}, and exceeds the ADEC risk threshold of 1×10^{-5}. The concentration of 1,2,3-trichloropropane detected (1.2 μg/L) at well MW79 contributes all risk at this well. Other wells exceeding the EPA target risk range include MW47 (9×10^{-4}) and MW08 (4×10^{-4}), also largely because of the 1,2,3-trichloropropane in these wells. The risk calculation data sheets for the 12 near-capture-zone wells are provided as a separate subsection in Appendix M.

Multimedia Risk Characterization for Reasonably Anticipated Future Use (Residential) Scenario. To address the possibility that future residents could be exposed to more than one medium at the FCS, the cumulative multimedia risk and hazard estimates were calculated as the sum of the risks and hazards for each exposure medium.

The multimedia HI and ELCR estimates for the future residential exposure scenario are summarized in Table 7-10. The multimedia HI for combined exposure by direct contact with surface soil, inhalation of indoor air originating from subslab soil-gas, and domestic use of FWA supply well (at Building 3559) groundwater is 0.5 for this scenario, which is below the EPA and ADEC threshold value of 1. The multimedia ELCR for combined exposure to these media is 1×10^{-5}, which does not exceed the EPA target risk range of 1×10^{-6} to 1×10^{-4} or the ADEC risk threshold of 1×10^{-5}. These cumulative multimedia risk estimates are very conservative because they assume exposure to maximum risk soil and subslab soil-gas locations, regardless of whether these locations co-occur spatially.

If it was assumed that multimedia risk estimates included direct exposure to groundwater from any of the wells within the hypothetical high-end 1,700-gpm capture zone, rather than actual domestic use of FWA supply well water (the current and expected future condition), the multimedia risks would exceed both EPA and ADEC risk threshold values because of the 1,2,3-trichloropropane in some of these wells. However, based on passive soil-gas sample data and groundwater data for wells installed between the locations where 1,2,3-trichloropropane was detected and the water supply wells, there is no indication of migration toward the water supply wells.

Hypothetical Future Unrestricted Exposure Scenario. This exposure scenario is evaluated to address a no-action assumption and includes conservative default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media. The hypothetical unrestricted exposure scenario was evaluated for potential exposure to COPCs detected in the following three exposure media:

- Surface soil (0 to 15 feet bgs)
- Soil-gas potentially migrating to indoor air
- Groundwater from well points across the site

The risk and hazard estimates for each of these media exposures are described in the following sections. The cumulative multimedia risk and hazard estimates for the hypothetical unrestricted exposure scenario, calculated as the sum of the risks and hazards for each exposure medium, are also described.

Direct Contact with Soil. The routes of exposure to COPCs in subsurface soil, assumed to be present under the hypothetical future unrestricted exposure scenario, include incidental ingestion, dermal contact, and inhalation of ambient dusts and vapors. The unrestricted user exposure assumptions were identical to those used for the reasonably anticipated future use (residential) scenario, where exposure was assumed to be for 350 days per year over a duration of 30 years[13] (for the first 6 years as a 15-kg child, followed by 24 years as a 70-kg adult). A total of 1,500 subsurface soil samples from 0 to 15 ft bgs were used for the unrestricted user scenario risk evaluation, and are listed in Appendix M, Table M-2. Because the risk estimates for 347 samples in the top 2 feet bgs would be the same as those for the reasonably anticipated future use (residential) scenario, they are not repeated in this section.

As was done for the reasonably anticipated future use (residential) scenario, a conservative, sample-specific, risk evaluation approach is used to evaluate potential exposure to subsurface soil for the hypothetical unrestricted scenario.

The sample-specific HI and ELCR estimates for the hypothetical unrestricted exposure scenario are summarized in Table 7-11. The estimated HIs for noncarcinogenic chemicals in subsurface soil samples range from less than 0.001 to a maximum of 5 (at location 06TP19S02) for this scenario, which exceeds the EPA and ADEC threshold value of 1. Only one (6 ft bgs at location 06TP19S02) of the 1,500 samples (less than 0.1 percent) evaluated under this scenario had a HI exceeding unity. The estimated ELCR from all carcinogenic chemicals in subsurface soil samples ranges from 9×10^{-12} to a maximum of 8×10^{-5} (at location 08-FW-A-EXBLD24-19-4), which is within the EPA target risk range of 1×10^{-6} to 1×10^{-4} but above the ADEC risk threshold of 1×10^{-5}. Of the 1,500 samples evaluated under this scenario, only four samples (0.3 percent) had risk estimates exceeding 1×10^{-6}. These locations and associated sample depths include: 08-FW-A- EXBLD24-19-4 (4 feet bgs), 07FW-A-EXBld4806R1B (8 feet bgs), 07FW-A-EXBLD48-43 (3 feet bgs), and 07FWAMW62-3.0 (3 feet bgs). The sample-specific risk calculation data sheets for subsurface soil are provided as a separate subsection in Appendix M.

The maximum concentration of lead in surface soil (289 mg/kg) for this exposure scenario does not exceed the ADEC Table B1 value of 400 mg/kg.

Inhalation of Indoor Air. Inhalation exposure to COPCs in indoor air potentially originating from soil-gas was evaluated under the reasonable future residential exposure scenario, and the results presented under that scenario are anticipated to be the same for the hypothetical unrestricted exposure scenario.

Hypothetical Domestic Use of Onsite Groundwater. Potential routes of exposure to COPCs in groundwater under this scenario include ingestion, dermal contact, and inhalation of vapors during bathing/showering. The hypothetical unrestricted exposure scenario assumed

[13] This EPA default assumption is considered conservative for the FCS because the reasonable maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years.

exposure for 350 days per year over a duration of 30 years[14] (for the first 6 years as a 15-kg child, followed by 24 years as a 70-kg adult). A total of 76 additional wells (other than the 12 wells evaluated under the reasonably anticipated future residential exposure scenario) were included in the evaluation of the unrestricted exposure scenario.

The HI and ELCR estimates for onsite groundwater use under the hypothetical unrestricted exposure scenario are summarized in Table 7-12. The estimated HIs for noncarcinogenic chemicals range from less than 0.0001 to a maximum of 16 (at MW12), which exceeds the EPA and ADEC threshold value of 1. The estimated ELCR from all carcinogenic chemicals in onsite groundwater samples ranges to a maximum of 8×10^{-4} at well MW03, which exceeds the EPA target risk range of 1×10^{-6} to 1×10^{-4} and the ADEC risk threshold of 1×10^{-5}. Arsenic contributes nearly all (more than 99 percent) of the risk at this well. However, the arsenic concentration detected at this well was 36.4 μg/L, consistent with the background concentration of 36.24 μg/L. Major risk contributors for the other wells that exceed regulatory risk thresholds are listed in Table 7-12. The risk calculation data sheets for the onsite wells are provided as a separate subsection in Appendix M.

Multimedia Risk Characterization for Hypothetical Unrestricted Exposure Scenario. Under the assumption that hypothetical unrestricted users would be exposed to more than one medium at the FCS, the cumulative multimedia risk and hazard estimates were calculated as the sum of the risks and hazards for each exposure medium.

The multimedia HI and ELCR estimates for the hypothetical unrestricted scenario are summarized in Table 7-13. The multimedia HI for combined exposure by direct contact with subsurface soil, inhalation of indoor air originating from subslab soil-gas, and domestic use of onsite groundwater is 21 for this scenario, which is above the EPA and ADEC threshold value of 1. The multimedia ELCR for combined exposure to these media is 2×10^{-3}, which is above the EPA target risk range of 1×10^{-6} to 1×10^{-4} and the ADEC risk threshold of 1×10^{-5}. The primary medium contributing to the multimedia risk is groundwater, contributing 95 percent of the cumulative risk.

7.5.5 Conclusions from the HHRA

This HHRA was conducted in accordance with EPA and ADEC risk assessment guidance. Risks were estimated for the most plausible pathways of human exposure, based on reasonably anticipated land uses at the FCS. These exposure scenarios evaluated included reasonably anticipated future residential, recreational/site visitor, maintenance worker, and excavation worker receptor groups. In addition, a hypothetical unrestricted exposure scenario is evaluated assuming no action and includes conservative default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media.

For the future recreational/site visitor, maintenance worker, and future excavation worker exposure scenarios, a conservative screening approach was used to select exposure concentrations, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it

---

[14] This EPA default assumption is considered conservative for the FCS because the reasonable maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years.

assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary. The HHRA results for these three exposure scenarios, summarized in Table 7-5, indicate that the HIs for noncarcinogenic chemicals in soil are below the EPA and ADEC threshold value of 1. The ELCR estimates are within or below the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. Therefore, no unacceptable risk is identified for these scenarios.

Residents living at the FCS under reasonably anticipated future land use conditions were evaluated for potential exposure to chemicals detected in the following three exposure media:

- Surface soil (0 to 2 feet bgs)
- Soil-gas potentially migrating to indoor air
- FWA supply groundwater currently used for domestic purposes

The multimedia HI and ELCR estimates for the future residential exposure scenario are summarized in Table 7-10. The multimedia HI for combined exposure by direct contact with surface soil, inhalation of indoor air originating from subslab soil-gas, and domestic use of FWA supply well groundwater is below the EPA and ADEC threshold value of 1. The multimedia ELCR for combined exposure to these media does not exceed the EPA target risk range of 1×10^{-6} to 1×10^{-4} or the ADEC risk threshold of 1×10^{-5}. The results of the reasonably anticipated future use (residential) scenario indicate that even if cumulative exposure occurs to the highest levels found at any single surface soil and subslab soil-gas locations, and is combined with exposure from domestic use of FWA supply water, HI and ELCR estimates do not exceed the EPA and ADEC risk threshold values. Therefore, no unacceptable risk is identified for the residential exposure scenario under reasonably anticipated future land use conditions. Moreover, any future exposures to soil will be further minimized by the clean soil cover that will be placed during completion of construction at the FCS and the implementation of Army Garrison policies that are in place to preclude digging at the property.

For groundwater wells located within the hypothetical high-end 1,700-gpm capture zone (but outside the current 1,000-gpm capture zone), the ELCR from all carcinogenic chemicals in groundwater samples exceeds the EPA target risk range of 1×10^{-6} to 1×10^{-4}, and the ADEC risk threshold of 1×10^{-5} (see Table 7-9) in wells MW08, MW47, and MW79 (the ELCR at MW39 exceeds the ADEC risk threshold only). This ELCR is primarily a result of the presence of 1,2,3-trichloropropane at low levels (less than 2 μg/L) in these wells.

The results of the hypothetical unrestricted exposure scenario indicate that, under the conservative default assumptions regarding domestic use of groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, HI and ELCR estimates are above the EPA and ADEC target risk thresholds. These risk estimates are provided for comparative purposes to document the difference between unrestricted access versus the potential risk when considering existing restrictions that preclude digging onsite, and prevent use of groundwater from areas other than the existing FWA supply wells.

7.6 Ecological Risk Assessment

The ERA presents an analysis of the potential for adverse ecological effects associated with contaminants at the FCS. The ERA was conducted in accordance with ADEC guidance (2009c) and EPA guidance (1992, 1997a, 1998). Both ADEC and EPA recommend using a phased approach. Each phase is more detailed and focused than the preceding one. Use of this approach focuses the ERA on the COPEC, receptors, and areas where the greatest potential for ecological exposure would be expected.

7.6.1 Organization of This Section

This ERA includes the following components:

- **Section 7.6.2: Phase 1 Ecoscoping Assessment**—identifies potential ecological exposure pathways. A summary of the results of Phase 1, Ecoscoping (Oasis, 2007), is provided.
- **Section 7.6.3: Phase 2 Screening Assessment—**initiates problem formulation for the FCS and provides a conservative screening to determine whether site-related chemicals could pose risks to aquatic or terrestrial wildlife; also identifies whether any chemicals should be classified as COPECs requiring further evaluation
- **Section 7.6.4: Conclusions from the ERA—** summarizes the ERA and discusses whether ecological risks support a no further action (NFA) determination or remedial actions should be evaluated

7.6.2 Phase 1 Ecoscoping Assessment

Ecoscoping provides a conservative qualitative determination of whether there is any reason to believe that ecological receptors, exposure pathways, or both are present or potentially present at or near the facility (ADEC, 2009c). The primary purpose of ecoscoping is to determine whether further ecological evaluation is warranted. During the ecoscoping process, a series of factors are considered; for example, determining visually if there are obvious signs of toxicity and identifying areas that are obviously devoid of ecological exposures or where ecological exposures could occur (through evaluation of habitat quality and contaminant occurrences). Ecoscoping forms were completed as part of the PSE I and were provided in Appendix F of the *Preliminary Source Evaluation 1 Narrative Report, Former Communications Site, Fort Wainwright, Alaska, Interim Final* (Oasis, 2007). These ecoscoping forms are also provided in Appendix M. The resulting information is summarized as follows:

- Potential ecological exposure to onsite soil is considered incomplete because of the lack of suitable habitat to support ecological populations.
- A screening-level ERA is warranted to evaluate potential exposures of aquatic resources and piscivorous (fish-eating) wildlife to chemicals in groundwater that could reach the Chena River.
- A screening-level ERA is warranted to evaluate risks to terrestrial wildlife (mammals and birds) potentially exposed to site-related chemicals in sediment from swales adjacent to the FCS.

The drainage swales only contain flowing water for a short time during the spring runoff season each year. Therefore, aquatic resources do not reside in the drainage swales. However, this ERA conservatively screens sediment samples collected from these swales to address the possibility of migration to the Chena River where benthic macroinvertebrates could be exposed.

Screening of media-specific concentrations was determined to be necessary as part of the second phase of the ERA, as described in the following section.

7.6.3 Phase 2 Screening Assessment

This section provides a screening assessment that addresses potential ecological exposure pathways. The Phase 2 screening assessment is an intentionally conservative evaluation that serves to eliminate from further evaluation analytes and areas that obviously do not pose a risk to the environment, despite a bias toward overestimating risk.

Data Used for the Ecological Risk Assessment

Data used for the ERA were obtained from samples collected in 2007 through 2009, as part of the RI at the FCS. Analytical data considered in the ERA are presented in Tables 7-14 and 7-15. The data set includes drainage swale surface soil/sediment (zero to 2 feet bgs) and groundwater collected for the purpose of site characterization. All chemicals detected (including estimated values) were used in the ERA.

Drainage Swale Samples. Analytical data (Table 7-14) from three surface soil/sediment samples (and one duplicate sample) (Figure 3-5) collected in the drainage swale occupying less than half of an acre on the northeast portion of the FCS were used for the ERA. These three samples were judgmentally collected at locations where the highest concentrations were anticipated and are considered adequate for decisions regarding offsite migration into this intermittent drainage during snowmelt. The swale has been re-engineered/improved and is now gravel lined. A total of 41 chemicals, including metals, PAHs, organochlorine pesticides, VOCs, SVOCs, and petroleum compounds, were detected in the drainage swale samples.

Groundwater Samples. Analytical data (see Table 7-15) from 10 groundwater locations were used for the ERA. These samples were collected from the northern-most, downgradient monitoring wells (MW35, MW36, MW37, MW38, MW40, MW41, MW77, MW82, MW83, and MW84; shown on Figure 3-7) nearest the Chena River. These seven monitoring wells are located along the northern edge of the FCS. A total of 54 chemicals, including metals, PAHs, organochlorine pesticides, VOCs, SVOCs, explosive compounds, and DRO, were detected in at least one of the perimeter groundwater wells. Groundwater data from additional nearby wells are used to assess the degree of spatial attenuation.

Selection of Chemicals of Potential Ecological Concern

COPECs are those chemicals that should be carried forward to the next phase of the ERA process. This section summarizes those chemicals detected during 2007 through 2009 site investigations and identifies the COPECs for environmental media that could be accessible through ecological exposure routes.

Consistent with ADEC guidance (2009c), detected chemicals are considered COPECs requiring further evaluation if they meet one of the following criteria:

- Maximum detected chemical concentrations exceed ecological risk-based screening concentrations (ERBSC) provided in Appendix D of Ecoscoping Guidance (ADEC, 2009c).
- Chemical is identified as potentially bioaccumulative according to Appendix C of Ecoscoping Guidance (ADEC, 2009c).

On the basis of these selection criteria, 29 COPECs were identified for drainage swale soil/sediment and 16 COPECs were identified for groundwater (see Tables 7-14 and 7-15). As noted by ADEC (2009b, 2009c), the screening criteria used for COPEC selection are the most conservative of a number of benchmarks. Chemical concentrations exceeding those benchmarks were identified as COPECs. Per ADEC's (2009b) Scoping Factor 5, these COPECs require a more indepth look that may include use of other applicable screening benchmarks protective of site receptors and conditions. This evaluation was done through additional screening, as described in the section titled, Screening Methodology and Results.

Conceptual Exposure Model

The ecological setting and CEM are provided in Sections 2.7 and 7.4, respectively. Both EPA guidance (EPA, 1998) and the ADEC 2009 Ecoscoping Guidance (Scoping Factor 3) (ADEC, 2009b) consider the quality and availability of habitat as important factors for determining whether an ERA for onsite exposure to soil is needed. The ADEC guidance states that "Industrialized or densely populated urban areas usually do not contain important habitats. Typically, most of the natural vegetation that could support wildlife has been removed" (ADEC, 2009b). Because no quality habitat exists or will exist at the site that is capable of supporting ecological populations, an ERA for onsite soil is unnecessary.

Based on ecoscoping (see Appendix M) and information obtained during the RI, plausible ecological exposure pathways identified in the CSM (see Section 7.4 and Figure 7-2) are as follows:

- Potential exposures of aquatic resources and piscivorous (fish-eating) wildlife to chemicals in groundwater that could reach the Chena River
- Potential exposure of terrestrial wildlife (mammals and birds) to site-related chemicals in sediment from drainage swales adjacent to the FCS
- Hypothetical exposure of benthic macroinvertebrates to drainage swale sediments potentially migrating to the Chena River[15]

Considering this, the Phase 2 Screening Assessment evaluates ecological exposures associated with 1) soil/sediment in the drainage swales, and 2) groundwater in monitoring wells nearest to the Chena River and downgradient (north) from the FCS.

Screening Methodology and Results

This ERA provides a screening consistent with the approaches recommended in ADEC guidance (ADEC, 2009c), and in Step 2 of the EPA eight-step ERA process (EPA, 1997b). The following sections describe the screening methodology and results.

---

[15] It should be noted that there are no sediment-dwelling organisms in the drainage swale.

Screening Methodology. As recommended in ADEC guidance (ADEC, 2009b, 2009c), the screening-level risk assessment should provide further evaluation of site data exceeding ADEC ERBSCs (ADEC, 2009b) or that have been identified as potentially bioaccumulative. Therefore, drainage swale soil/sediment and groundwater concentrations for COPECs identified in the section titled, Selection of Chemicals of Potential Ecological Concern, were compared directly with levels believed to be protective of ecological receptors near the FCS. The following screening benchmarks were used to determine the potential for adverse effects on ecological receptors:

- For riparian and aquatic birds and mammals potentially exposed through the food chain, individual drainage swale samples were compared directly with EPA ecological soil screening levels (EcoSSL) protective of birds and mammals (EPA, 2005a, 2005b, 2008a). EcoSSLs incorporate both direct exposure (e.g., incidental ingestion of soil) and exposure through bioaccumulation into food items. EcoSSLs are conservative benchmarks developed specifically for use in Step 2 of the EPA ERA process.
- Drainage swale samples were compared with threshold effects concentrations (TEC) and probable effects concentrations (PEC) (MacDonald et al., 2000), and with threshold effects levels (TEL) and probable effects levels (PEL) from the *Screening Quick Reference Tables* (National Oceanic and Atmospheric Administration [NOAA], 2009).
- For benthic and aquatic resources at the Chena River, results from individual groundwater samples were compared directly with EPA chronic and acute ambient water quality criteria (WQC) (EPA, 2009c).

In addition to the benchmark screening, spatial attenuation of contaminant concentrations and naturally occurring levels of metals were considered as other lines of evidence in the ERA. Metals with site concentrations within the reported range of natural conditions would not require additional evaluation.

Summary of Screening Results. The section provides results for the ecological screening at the FCS.

Screening Results for Birds and Mammals. Table 7-14 provides the results of comparing drainage swale samples with soil screening benchmarks considered protective of terrestrial birds and mammals. Of the 41 chemicals detected in drainage swale soil/sediment, 29 were selected as COPECs. Ten of the 29 COPECs—antimony, cadmium, chromium, copper, lead, selenium, vanadium, zinc, dichlorodiphenyldichloroethene (DDE), and dichlorodiphenyltrichloroethane (DDT)—exceeded either bird or mammal EcoSSLs. Several COPECs were also identified as potentially bioaccumulative through application of ADEC criteria (bioconcentration factor [BCF] greater than 1,000 or log octanol-water partition coefficient [K_{ow}] greater than 3.5).

For COPECs exceeding EcoSSLs for either birds or mammals, exceedances by the maximum detected concentrations are relatively low; that is, all factors of exceedances are 10 or less, as follows:

- Antimony—maximum detected concentration (1.8 mg/kg) exceeds the EcoSSL for mammals by a factor of 6.7

- Cadmium—maximum detected concentration (0.67 mg/kg) exceeds the EcoSSL for mammals by a factor of 1.9
- Chromium—maximum detected concentration (33.9 mg/kg) exceeds the EcoSSL for birds by a factor of 1.3
- Copper—maximum detected concentration (55.1 mg/kg) exceeds the EcoSSL for birds by a factor of 2.0
- Lead—maximum detected concentration (60 mg/kg) exceeds the EcoSSL for birds by a factor of 5.5
- Selenium—maximum detected concentration (0.93 mg/kg) exceeds the EcoSSL for mammals by a factor of 1.5
- Vanadium—maximum detected concentration (49.5 mg/kg) exceeds the EcoSSL for birds by a factor of 6.3
- Zinc—maximum detected concentration (252 mg/kg) exceeds the EcoSSL for mammals by a factor of 5.5
- DDE—maximum detected concentration exceeds the EcoSSL for mammals by a factor of 1.7
- DDT—maximum detected concentration exceeds the EcoSSL for mammals by a factor of 7.6

Because the EcoSSLs used for the screening assessment conservatively assume that all wildlife exposure is limited to the small location (less than 0.5 acre) where ecological exposures are possible, exceedance of some screening levels can be expected. The screening results summarized above are based on the highly conservative assumption that ecological receptors receive all their food from the small swale northeast of the FCS. In reality, only a small portion of their forage (and thus exposure) would come from such a small area. When considering the documented home ranges (Table 7-16) for potential ecological receptors that might be expected at FWA (such as the northern harrier, kestrel, mallard, red fox, mink, and hare; see Appendix D of the Postwide Risk Assessment Fort Wainwright, Alaska; HLA, 1997), the exposure rate is expected to be well below the unacceptable levels. For example, the hare has a reported home range of about 14.5 acres and the drainage swale represents only about 3.4 percent of this hare foraging area. This fraction can be used as a numerical adjustment to the exceedance factors listed above. Given the low factors of exceedance listed above and the foraging areas for representative wildlife, it is not anticipated that the levels found in 2007 would pose meaningful risk of ecological importance.

Screening Results for Aquatic and Benthic Resources. Table 7-14 compares maximum detected concentrations from drainage swale soil/sediment samples with sediment benchmarks, and Table 7-15 compares maximum detected concentrations from groundwater with WQC. The screening levels used are considered protective of benthic and aquatic resources. The results by medium are provided in this section.

Drainage Swale Surface Soil/Sediment. Of the 41 chemicals detected in drainage swale soil/sediment, 29 were selected as COPECs. Of these 29, only arsenic and nickel were detected at maximum concentrations exceeding the corresponding PEL:

- Arsenic—maximum detected concentration exceeds the PEL by a factor of 1.5
- Nickel—maximum detected concentration exceeds the PEL by a factor of 1.1

None of the COPECs (including nickel and arsenic) exceeds its respective PEC. The PEC is considered a more reliable benchmark than the PEL because it represents a consensus-based sediment quality guideline (MacDonald et al., 2000) that includes consideration of multiple reported guidelines, including PELs. Given that none of the COPECs exceeds its PEC, the exceedances of PELs are low, and without consideration of the degree of attenuation associated with migration of drainage swale sediments to the Chena River, the risk posed by drainage swale samples to aquatic/benthic organisms is considered low.

The likelihood of significant migration of sediment from the drainage swale to the Chena River is considered very low as a result low gradient and limited surface drainage flows. The drainage swale receives seasonal runoff water from offsite (the adjacent housing area to the west). Additionally, given the large distance (1,500 feet) between the drainage swale and the Chena River, significant attenuation would be expected over a relatively short distance. This can be clearly seen from the concentration gradient exhibited for 4,4'-DDT, with levels of 0.16, 0.023, and 0.008 mg/kg at sample locations DSS01-01, DSS01-03, and DSS01-02, respectively (locations listed from upstream to downstream). Since the swale samples were collected in 2007, the swale has been re-engineered, and includes a bed of 3 to 6 inches of coarse gravel and is vegetated.

Consideration of Background Levels for Metals. Although site-specific background data for soil/sediment are not available for the metals above, it should be noted that the background concentrations in Alaska soils as reported by USACE (1994) and USGS (1988) are as follows:

- Antimony—not available.
- Cadmium—reported background value for both north and south of the Chena River is 0.6 mg/kg (USACE, 1994).
- Chromium—reported background value for south of the Chena River is 15 mg/kg (USACE, 1994). USGS (1988) reports background ranges from 5 to 390 mg/kg with a geometric mean of 55 mg/kg.
- Copper—USGS (1988) reports background ranges from 3 to 810 mg/kg with a geometric mean of 24 mg/kg.
- Lead—recommended background value for south of the Chena River is 11 mg/kg (USACE, 1994). USGS (1988) reports background ranges from less than 4 to 310 mg/kg with a geometric mean of 12 mg/kg.
- Selenium—not available.
- Vanadium—USGS (1988) reports background ranges from 11 to 490 mg/kg with a geometric mean of 112 mg/kg.

- Zinc—USGS (1988) reports background ranges from less than 20 to 2,700 mg/kg with a geometric mean of 70 mg/kg.

These levels indicate that the maximum concentrations of metals in drainage swale samples appear to be within levels that could naturally occur within Alaska, although background data were not available for all metals (for example, antimony and selenium).

Potential Offsite Discharge of Groundwater. Of the 54 chemicals detected in groundwater along the northern perimeter of the FCS, 16 were selected as COPECs because they exceeded the ADEC ERBSCs. Of these 16 chemicals, only selenium (once over five sampling events) was detected at a maximum concentration exceeding acute WQC; only total aluminum, total copper, total iron, total nickel, total selenium, alpha-chlordane, gamma-chlordane, and DDT concentrations exceeded chronic WQC:

- Aluminum, arsenic, barium, iron, lead, and manganese concentrations were detected at concentrations consistent with background levels.
- Selenium exceeded the chronic WQC in only two wells (MW35 and MW36) by a maximum factor of 3.6.
- Alpha- and gamma-chlordane exceeded the chronic WQC by maximum factors of 1.5 and 2.2, respectively. Detected levels were measured in only one sample each (occurring during October 2008 for alpha-chlordane at MW36 and gamma-chlordane at MW77). Two subsequent results for alpha- and gamma-chlordane at each well resulted in non-detected levels; however, detection limits were about two times the chronic WQC.
- DDT was detected at only one (MW38) of the seven perimeter wells evaluated. DDT exceeded the chronic WQC by a maximum factor of 13 (in October 2007). Four subsequent results for MW38 resulted in non-detected levels of DDT; however, the detection limits were above the chronic WQC.

Boron, cobalt, naphthalene, and toluene were identified as COPECs because they exceeded ADEC ERBSC aquatic screening levels. WQC were not available for use in evaluating these COPECs. Boron and cobalt background was unavailable; however, detected levels in wells throughout the area indicate that boron is ubiquitous and no source areas are apparent. Naphthalene was not detected above the ADEC ERBSC in the two most recent sampling events. Toluene was not detected in any well during the two most recent sampling events. Additionally, the maximum detected toluene concentration (2.9 µg/L) is below its respective chronic screening benchmark (9.8 µg/L) recommend by NOAA (2009).

Considering that the distance between the northern perimeter monitoring wells and the Chena River is greater than 1,500 feet, significant attenuation is expected before groundwater reaches actual aquatic or benthic receptors in the Chena River. This attenuation would be a result of biodegradation, dispersion, dilution, adsorption, volatilization, and chemical or biological stabilization or destruction of constituents. To provide some indication of the degree of spatial attenuation that could occur at the site, levels of TCE were evaluated because this chemical is relatively persistent in groundwater and is believed to have originated from onsite groundwater and migrated north of the FCS. TCE concentrations were compared between MW77 and MW 84 (see locations on Figure 3-7), which is located approximately 450 feet downgradient of MW77. The TCE measured at MW77 were 1.81 and 1.28 µg/L in June and September 2009, respectively, while TCE was not detected (method detection limit was 0.014 µg/L) in MW84 in November 2009. This indicates that TCE concentrations have attenuated about a hundredfold over this distance. Given the distance between the wells evaluated in this ERA and the Chena River, and the inferred extent of attenuation observed prior to reaching the river, the level of exposure and risk posed to offsite aquatic resources through groundwater migration from the FCS to the Chena River is considered to be low. Another line of evidence in support of this conclusion is the observation that residual contamination is relatively isolated onsite, fairly well understood, and likely to remain contained onsite (see Section 5).

7.6.4 Conclusions from the ERA

The ERA was conducted in accordance with ADEC and EPA guidance, focusing on COPECs, receptors, and areas where the greatest potential for ecological exposure might be expected. The risk to offsite terrestrial wildlife and offsite aquatic resources potentially exposed to the COPECs occurring in the drainage swale and groundwater is considered to be low. This conclusion was drawn in consideration of 1) likely infrequent use of small drainage swales, 2) their ephemeral nature, 3) the relatively low magnitudes by which COPEC concentrations exceed conservative screening levels, and 4) the expected amount of spatial attenuation, indicating that unacceptable risk to ecological populations is unlikely. Given these findings, no COPECS or areas were identified that would require additional sampling and evaluation from the drainage swale or perimeter well points to protect ecological resources potentially using the FCS.

7.7 Uncertainties Associated with the Risk Assessments

Full characterization of human health and ecological risks requires that the numerical estimates of risk presented in the risk assessments be accompanied by a discussion of the uncertainties inherent in the assumptions used to estimate those risks. Uncertainties in risk assessment methods could result in either understating or overstating the risks. The latter is likely the case when health-conservative assumptions are used to characterize risk. Several sources of uncertainty can affect the overall estimates of human and ecological health presented in this assessment. The sources are generally associated with the following:

- Sampling, analysis, and data evaluation
- Chemical fate and transport estimation
- Exposure assessment
- Toxicity assessment
- Risk estimation

These sources of uncertainty are discussed in the following sections.

7.7.1 Uncertainties Associated With Sampling, Analysis, and Data Evaluation

Uncertainties associated with soil, soil-gas, and groundwater sampling and analysis include the inherent variability (standard error) in the analysis, the representativeness of the samples, sampling errors, and heterogeneity of the sample matrix. The quality assurance and quality control program used during the various investigations serves to maintain acceptable precision and accuracy in measurement of chemical concentrations, but it cannot eliminate all errors associated with sampling and analysis.

The degree to which sample collection and analyses reflect real exposure concentrations will influence the reliability of the risk estimates. Because of the history of investigations and removal actions completed at the FCS, soil sampling strategies have been both judgmental and systematic across the FCS. Judgmental samples were collected, for example, as confirmation samples at targeted drum and debris removal areas where geophysical anomalies were observed and at known or suspected hot spot areas. Subslab soil-gas sampling included complete coverage of all 110 residential living units. Because the sampling for these media was roughly evenly spaced with high spatial density across the FCS, it is anticipated that the concentrations generally reflect what people could be exposed to if they reside, visit, or work at the FCS.

Other specific assumptions made related to sampling, analysis, and data evaluation include the following:

- Although a few analytes consistently had ND MDLs that exceeded their PSLs, the elevated MDLs occurred in multiple investigations and appear to be more a function of limitations inherent in the standard analytical methods (relative to very low PSLs) than an indication of poor data quality. As noted in Section 5.3.6, this usually occurred for chemicals not associated with historic operations or the types of waste disposed of at the FCS (for example 1,2-dibromo-3-chloropropane) and whose detection may be the result of interferences from other chemicals in the area. For some constituents in some samples, matrix interferences caused detection limits to be elevated above the PSLs. In cases where undetected constituents are actually present below MDLs but above the PSL, there is a potential for some undetected risk. However, because PSLs are set at one-tenth the actual risk-based concentration, considerable margin of safety is afforded.
- Dioxins and furans were not included as analytes during the RI because research (de Voogt and Brinkman, 1989; DeGrandchamp and Barron, 2005) has shown that only trace levels of dioxins and furans are present in the type of PCB found at the FCS (Aroclor 1260) and because areas of burned debris were not collocated with evidence of chlorinated solvent use. The following lines of evidence support the decision not to analyze samples for dioxins and furans:
    1. PCB-contaminated soil that might have contained PCB-associated dioxins/furans has been removed from the site.
    2. Soil samples collected from sidewalls and floors of excavations where burned material was found were analyzed for VOCs and none of the results suggested possible use of chlorinated solvents as an accelerant.
    3. IDWs (e.g., soil cuttings) associated with installation of MW80 and MW81 (located near the former Building 52 foundation) were analyzed for dioxins and furans and only trace levels were detected.

7.7.2 Uncertainties Associated with Chemical Fate and Transport Estimation

This risk assessments made simplifying assumptions about the environmental fate and transport of COPCs; specifically, that no chemical loss or transformation has occurred since the sampling data were collected, or will occur over the course of the assessed 30-year residential exposure duration. In cases for which natural attenuation or other degradation processes are moderate or high, the analytical data chosen to represent exposure concentrations likely overstate actual long-term exposure levels. This uncertainty is likely to be more relevant for organic chemicals that biodegrade (e.g., BTEX, DRO, and PAHs) than for those that are persistent in the environmental (for example, PCBs and metals). But even more persistent chemicals will attenuate to some degree over a 30-year period.

Other specific assumptions made related to fate and transport of COPCs include the following:

- For developing a conservative estimate of the subslab soil-gas to indoor air attenuation factor, site-specific radon data were collected for these media. The attenuation factor was derived as the 95 percent UCL from sampling 19 housing units of five styles for the HHRA. As an added conservative measure, the portion of the measured indoor concentrations of radon that is attributable to ambient background was not considered in the derivation of the attenuation factor (that is, background was not subtracted from measured indoor radon levels). Radon is considered a conservative tracer because of its inert nature as a noble gas (e.g., it does not biodegrade) and lack of chemical interaction with soil, as would be expected for organic VOCs.

- To provide a reliable representation of potential exposure concentrations, the subslab soil-gas sampling was conducted during seasonal extremes, once in winter in December 2008, and once in summer in August 2009. The heating and ventilation systems in each home were set to simulate typical living conditions. (Units were generally around 68°F at the time of sampling.)

- Two capture zones were modeled for the FWA water supply wells at Building 3559 to provide hypothetical bounding estimates on potential water use, one assuming a lower-end long-term average pumping rate (1,000 gpm); and one assuming a high-end rate (1,700 gpm) for the pumps installed in the wells. These values bracket the actual (as evidenced by data records from 2005-2010) long-term production rate of 1,327 gpm, as described in Section 2.1.5. The wells affected by 1,2,3-trichloropropane are located outside the 1,000-gpm capture zone for the FWA water supply well and, based on passive soil-gas sample data and groundwater data for wells installed between the locations where 1,2,3-trichloropropane was detected and the water supply wells, there is no indication of migration toward the water supply wells.

7.7.3 Uncertainties Associated with Exposure Assessment

The estimation of exposure in these risk assessments required many assumptions. There are uncertainties regarding the likelihood of exposure, frequency of contact with contaminated media, concentrations of chemicals at exposure points, and total duration of exposure. The human exposure assumptions used in the risk estimates (see Tables 7-1 and 7-2) are intended to be conservative and likely overestimate the actual risk or hazard. Specific assumptions made related to estimation of exposure include the following:

- A conservative screening approach was used to select exposure concentrations for the future maintenance worker, excavation worker, and recreational/site visitor exposure scenarios, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary for these scenarios.

- A conservative sample-specific risk evaluation approach was used to evaluate potential exposure to surface soil for the future residential exposure scenario. This is considered a screening-level approach because long-term exposure (30-year duration) is assumed to occur at each individual sample location. In reality, exposure would be spatially integrated over a much larger area than represented by a single sample location. There would be a potential for some additive risk if an individual receptor is equally exposed to two or more locations that are in close proximity. However, when the 10 highest risk locations (those with highest risk estimates in Table 7-6) were evaluated to determine proximity to each other, none co-occur within the same residential yard. Therefore, combined exposure to these locations is not expected.

- A conservative residence time of 30 years was assumed for the future residential exposure scenario. This value is the EPA-default assumption representing the national upper bound time at one residence (EPA, 1989), and is considered conservative for the FCS because the reasonable maximum residence time for military housing at FWA is anticipated to be no longer than about 8 years. As a result, exposure will likely be less than a third of the level assumed in this HHRA.

- Any future exposures to soil will be further minimized by the clean soil cover (about 2 feet) that will be placed during completion of construction at the FCS and the implementation of Army Garrison policies that are in place to preclude digging at the property.

- Another uncertainty for the risk assessments is the bioavailability of the forms of metals that occur in soil and drainage swale sediment at the FCS. Site-specific bioavailability data were unavailable for all detected chemicals. The HHRA and ERA conservatively assume that bioavailability from soil/sediment is the same as that in the toxicological studies from which the toxicity values were derived. Depending on whether the chemical form at the site is less or more bioavailable than assumed, actual risk would be proportionately lower or higher, respectively.

- For locations where subslab soil-gas was sampled and analyzed during both December 2008 and August 2009, the annual average concentration was considered most representative of chronic exposure, commensurate with the toxicity factors used for risk assessment. Averaging the winter and summer subslab soil-gas results to derive an annual average was conducted to characterize the inherent cyclical nature of soil-gas at the temperature extremes present in Fairbanks. Thus, they are anticipated to capture the annual variation in the long-term (30-year) exposure assumed for the risk assessment. More recent soil-gas sampling results from July 2010 (results provided in Appendix R) showed that TCE concentrations were lower than those seen in the previous August 2009 event, but still within the range considered for averaging in the risk assessment. These more recent results indicate that the values used for the risk assessment are sufficiently conservative.

- During both the December 2008 and August 2009 subslab soil-gas sampling events, the heating and ventilation systems in each home were set to simulate typical living conditions (units were generally around 68°F at the time of sampling). As a result, the data are anticipated to represent reasonably anticipated future use (residential) conditions. The HHRA does not address potential exposures should the heating and ventilation systems require maintenance and be off intermittently. However, it is not anticipated that the frequency and duration of such events would be long enough to significantly alter the characteristics of vapor intrusion (if any), when compared with the long-term chronic exposures assumed for the characterization of risk for this pathway.

7.7.4 Uncertainties Associated with Toxicity Assessment

Uncertainties in toxicological data can also influence the reliability of risk management decisions. The toxicity values used for quantifying risk in this risk assessment have varying levels of confidence that could affect the confidence in the resulting risk estimates. The general sources of toxicological uncertainty include the following:

- Extrapolation of dose-response data derived from high dose exposures to adverse health effects that could occur at the low levels seen in the environment
- Extrapolation of dose-response data derived from short-term tests to predict effects of chronic exposures
- Extrapolation of dose-response data derived from animal studies to predict effects on humans
- Extrapolation of dose-response data from homogeneous populations to predict effects on the general population

The levels of uncertainty associated with the RfDs and RfCs for the COPCs (as judged by EPA) are expressed as uncertainty factors and modifying factors, and provided in IRIS or HEAST (discussed in Section 7.5.3). For chemicals suspected of resulting in cancer effects, uncertainty is in part expressed in terms of the EPA weight-of-evidence classification, shown in Table 7-3.

Other specific areas of toxicological uncertainty associated with the risk assessments are as follows:

- The HHRA used available chronic RfDs for the oral exposure route. This approach may represent a conservative measure for the future maintenance worker, excavation worker, and recreational/site visitor exposure scenarios, because it is most likely that any exposure would be intermittent and of shorter-than-lifetime duration.
- Toxicity values were not available from the sources listed in Section 7.5.3 for several chemicals detected; therefore, a surrogate toxicity factor for a structurally similar chemical was used.[16] If a structurally similar compound could not be identified, it was not carried forward into the risk assessment. Inclusion of these surrogates in the HHRA could result in an overestimation of risk at the site, if they, in fact, have higher toxicity than the chemical they are representing. Most often, chemicals without available toxicity

---

[16] The surrogate toxicity factors selected for the risk assessment are listed in Table 7-4.

data are generally considered less toxic because most of the toxicological literature focuses on the chemicals considered more toxic to human receptors.

- In cases for which the species of metal is unknown, the HHRA conservatively assumed the most toxic form is present. For example, the HHRA assumed that total chromium present in soil at the FCS is in the form of hexavalent chromium. It is very likely that only a small portion of total chromium in soil is present in the more toxic hexavalent form. Because hexavalent chromium is considered a carcinogen, assuming it is present when it is not results in ELCR overestimation.

- Dermal exposures are different from oral exposures because not all of a chemical that comes into contact with a person's skin travels across the various layers of epidermal tissue, as indicated by a skin permeability factor, and because the toxic effects produced from this route of exposure might not be the same as when the chemical is ingested. In lieu of available toxicity values for the dermal route, this HHRA uses oral toxicity values to estimate the effects of dermally available chemicals. This approach could result in an underestimation or an overestimation of risks, depending on whether a chemical is more or less toxic by the dermal route versus by ingestion.

- EPA is currently undergoing a reevaluation of the toxicology supporting the assessment of cancer risk from exposure to TCE. Recently, EPA released an External Review Draft of the *IRIS Toxicological Review of Trichloroethylene* (EPA, 2009d), providing TCE cancer slope factors that are expected to be added to its IRIS database in 2010 or early 2011. However, ADEC does not endorse these draft EPA factors until they are final, but instead requires the use of factors based on the upper-bound cancer slope factor identified in the EPA draft risk assessment for TCE (EPA, 2001). These draft slope factors are about 28-fold more stringent than the factors currently released by EPA. This HHRA uses the more conservative slope factors required by ADEC. However, for cases where risk estimates are found to be contributed by TCE using the ADEC toxicity factors, a corresponding risk is also estimated using the draft oral slope factor and IUR currently proposed by EPA (EPA, 2009d). These side-by-side risk estimates are included to allow risk managers to make the most informed risk management decisions, considering the most current understanding of the toxicology of TCE.

- As discussed in Section 4, during initial 2007 soil-gas sampling for the RI, MDLs for many of the target analytes were elevated because of the unanticipated presence of high levels of Freon-related compounds in the soil-gas. The Freon-related compounds were believed to be related to foam board and spray insulation construction of the housing development and were not considered target analytes for the RI. To address this interference, special analytical methods were used during the December 2008 subslab soil-gas sampling, to remove the negative influence on MDLs. At the request of ADEC, a risk screening of the freons that were TICs during 2007 was conducted. The TICs reported at 55 locations in 2007 included 1,1-difluoroethane (DFA) and 1-chloro-1,1-difluoroethane (CDFA). Indoor air concentrations were estimated from soil-gas concentrations by using site-specific attenuation factor, and the results were compared with EPA RSLs for these chemicals. Using the maximum detects for these two freons, HQs are 0.02 for DFA and 0.002 for CDFA. These results indicate that freons do not represent a source of unacceptable risk at the FCS.

- The toxicity reference values used to develop the EcoSSLs (benchmarks used for the ecological screening evaluation) are typically based on no observed adverse effect levels (NOAEL). However, actual toxicity is expected within the range between a NOAEL and the lowest bounded lowest observed adverse effect level (LOAEL).

7.7.5 Uncertainties Associated with Risk Characterization

In the risk characterization, the assumption was made that the total risk of developing cancer from exposure to site contaminants is the sum of the risk attributed to each individual contaminant. Likewise, the potential for the development of noncancer adverse effects is the sum of the HQs estimated for exposure to each individual contaminant. This approach, in accordance with EPA guidance, did not account for the possibility that chemicals act synergistically or antagonistically. Other specific assumptions made related to risk characterization include the following:

- The HHRA evaluated both the reasonably anticipated future use (residential) exposure scenario and the hypothetical unrestricted exposure scenario for comparative purposes to document the difference between unrestricted access versus the potential risk when considering existing restrictions that preclude digging onsite, and prevent use of groundwater from areas other than the existing FWA supply wells. When interpreting the results of this risk assessment, it should be noted that the hypothetical unrestricted exposure scenario results do not represent a reasonably likely outcome, but are provided as a comparative perspective.
- To address the possibility that future residents could be exposed to more than one medium at the FCS, the cumulative multimedia risk and hazard estimates were calculated as the sum of the risks and hazards for each exposure medium. The multimedia risk characterization conservatively assumed that cumulative exposure occurs to the highest levels at any surface soil and subslab soil-gas locations, combined with exposure from domestic use of FWA water supply water. Yet even with the use of this very conservative approach, HI and ELCR estimates are below the EPA and ADEC risk threshold values.
- Because some chemicals detected in site media occur naturally or are found regionally because of general anthropogenic sources, it is important, when interpreting risks, to consider the relative level of potential risk posed by naturally occurring or anthropogenic levels. For soil, only arsenic was excluded from the exposure estimates because arsenic concentrations are within levels typical of background near the FCS. Appendix K provides the methodology and results of the background comparison for arsenic. The maximum, mean, and median detected arsenic levels in the background data set were 38, 7.1, and 6.9 mg/kg, respectively, compared with the maximum, mean, and median levels in the FCS data set of 37.1, 9.0, and 8.0 mg/kg, respectively. However, even natural levels of arsenic exceed risk-based concentrations, including the ADEC Table B1 value of 4.5 mg/kg. Depending on the actual bioavailability of the arsenic from soil found around Fairbanks (which is likely well below the conservative 100 percent bioavailability assumed for the Table B1 value), if the natural levels of arsenic were to be included into the exposure estimates reported in the risk assessments, risks could be somewhat higher than reported. The maximum arsenic concentration detected in soil at

the FCS equates to a residential ELCR of 7×10^{-5} and a HQ of 0.4, and the maximum background arsenic equates to a residential ELCR of 8×10^{-5} and a HQ of 0.4.

- Ambient air contains anthropogenic levels of some VOCs that were also detected in subslab soil-gas at the FCS. To provide some perspective on the influence of ambient air background, risk estimates were calculated for samples collected at the perimeter fence at the FCS (see Table 7-8). However, ambient background levels were not subtracted from the levels measured in subslab soil-gas. This conservative approach provides added confidence that the risk and hazard estimates for the vapor intrusion pathway are reliable for decision making.

- As discussed in Sections 4.4 and 5.5.2, some residual debris could not be removed because of concerns about the structural stability of nearby buildings. Buildings where debris appeared to continue beneath the foundation and could not be removed are shown on Figure 4-3. The presence of buried metal does not always correlate with the presence of intact drums of chemicals or contaminated soil; it is only a suggestion that such conditions are possible. A weight-of-evidence evaluation was conducted to determine the plausibility that 1) a drum could exist that was intact, and 2) what the most plausible contents of such a drum could be (see Table 5-10). The available lines of evidence seem to indicate that, based on past observations, the probability of intact drums remaining is low (because less than 0.5 percent of those found had enough liquid or tar-like substance in them to collect samples for analysis), and any liquid contents of such a drum would most reasonably contain some type of petroleum-based liquid. Once the living units at the FCS become occupied, the Army will be implementing a subslab soil-gas-monitoring program to provide documentation that subslab soil-gas levels of site-related VOCs are not increasing to meaningful levels. Moreover, Army Garrison policies are currently in place precluding digging onsite. Petroleum compounds tend to have higher degradation rates and lower toxicity than halogenated solvents. The estimated levels of petroleum compounds that would need to be detected in subslab soil-gas that could pose intermediate exposure risk to residents would be many orders of magnitude higher than any of the levels seen during the RI. For example, the levels of BTEX that would need to be detected in subslab soil-gas to pose intermediate exposure risk (based on the published ATSDR minimal risk levels; ATSDR, 2009) would be 8.7; 136; 1,372; and 1,177 mg/m^3, for benzene, toluene, ethylbenzene, and xylene, respectively.[17] These subslab soil-gas levels are greater than 7,900-fold, 22,000-fold, 150,000-fold, and 12,700-fold higher than the maximum levels detected during the RI of 0.0011, 0.0061, 0.0089, and 0.092 mg/m^3, respectively, for BTEX.

---

[17] These values were calculated by dividing the ATSDR intermediate (or in the case of toluene, chronic) MRLs by the site-specific subslab soil-gas to indoor air attenuation factor of 0.0022 for radon.

TABLE 7-1
Summary of Exposure Assumptions for Soil Risk Estimates
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Parameter	Units	Future Resident and Hypothetical Unrestricted use	Sources	Future Maintenance Worker	Sources	Future Excavation Worker	Sources	Site Visitor/ Recreational User	Sources
Body Weight - adult	kg	70	ae	70	ae	70	ae	--	--
Body Weight - child	kg	15	be	--	--	--	--	36.3	n
Carcinogenic Averaging Time	yrs	70	ae	70	ae	70	ae	70	ae
Noncarcinogenic Averaging Time	yrs	30*	be	6.6	c	6.6	c	8	m
Exposure Frequency	day/yr	270	e	250	e	20	f	28	d
Exposure Duration - Adult	yrs	24*	be	6.6	c	6.6	c	--	--
Exposure Duration - Child	yrs	6*	be	--	--	--	--	8	d
Incidental Soil Ingestion Rate - Adult	mg/day	100	be	100	b	330	g	--	--
Incidental Soil Ingestion Rate - Child	mg/day	200	be	--	--	--	--	200	be
Age-Adjusted Soil Ingestion Rate	mg-yr/kg-day	114	h	--	--	--	--	--	--
Age-Adjusted Soil Ingestion Rate (mutagen)	mg-yr/kg-day	490	h	--	--	--	--	--	--
Skin Surface Area - Adult	cm^2/day	5,700	ie	3,300	ie	3,300	ie	--	--
Skin Surface Area - Child	cm^2/day	2,800	ie	--	--	--	--	3,800	o
Dermal Absorption Factor	unitless	Chemical-specific	j	Chemical-specific	j	Chemical-specific	j	Chemical-specific	j
Dermal Adherence Factor - Adult	mg/cm^2	0.07	ie	0.2	ie	0.2	ie	--	--
Dermal Adherence Factor - Child	mg/cm^2	0.2	ie	--	--	--	--	0.2	ie
Age-Adjusted Dermal Factor	cm^2-yr/kg-day	361	k	--	--	--	--	--	--
Age-Adjusted Dermal Factor (mutagen)	cm^2-yr/kg-day	1,445	k	--	--	--	--	--	--
Inhalation Exposure Time	hr/day	24	b	8	b	8	b	24	b
Particulate Emission Factor	m^3/kg	1.32E+09	l	1.32E+09	l	1.32E+09	l	1.32E+09	l
Volatilization Factor	m^3/kg	Chemical-specific	l	Chemical-specific	l	Chemical-specific	l	Chemical-specific	l

Note: Some exposure assumptions presented here deviate from those specified in the 2007 Human Health and Ecological Risk Assessment Work Plan to include the most current default values from EPA guidances.

Source:

a. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part A, Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002 (EPA, 1989).

b. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. (EPA, 1991).

c. Exposure Factors Handbook Volume I General Factors. EPA/600/P-95/002Fa. August 1997.

d. Based on professional judgement; assumes receptor is exposed 1 day per week, 7 months per year, over a 8 year duration

e. Table 1 of Risk Assessment Procedures Manual (ADEC, 2009)

f. Based on professional judgement; assumes receptor is on site during excavation activities for 5 days per week, four weeks per year, over a 6.6 year duration.

g. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24 (EPA 2002).

h. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, (Part B, Development of Risk-Based Preliminary Remediation Goals) EPA/540/R-92/003. Publication 9285.7-01B. (EPA 1991). For mutagens, see Regional Screening Levels User's Guide (EPA, May 2010) http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

i. Exhibit 3-5 of Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005. OSWER 9285.7-02EP (EPA, 2004).

j. Exhibit 3-4 of Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005. OSWER 9285.7-02EP (EPA, 2004).

k. Equation 3.21 of Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005. OSWER 9285.7-02EP (EPA, 2004). For mutagens, see Regional Screening Levels User's Guide (EPA, May 2010) http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

l. Soil Screening Guidance: Users Guide. EPA/540/R-96/018. Office of Emergency and Remedial Response, Washington, D.C. PB96-963505.

m. Based on professional judgement; assumes receptor visits over a 8 year period, the reasonable maximum residence time at Fort Wainwright.

n. Table 7-3, Average body weight of 10 yr-old male and female children. Exposure Factors Handbook Volume I General Factors. EPA/600/P-95/002Fa. (EPA, 1997).

o. Exhibit C-1- surface area based on 10-yr old with head, hands, forearms, and lower legs exposed; RAGS, Vol 1, Part E Supplemental Guidance for Dermal Risk Assessment. Final. (EPA, 2004).

* The default exposure duration was conservatively used, even though the reasonable maximum residence time at Fort Wainwright is about 8 years.

TABLE 7-2

Summary of Exposure Assumptions for Groundwater and Indoor Air Risk Estimates

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Parameter	Units	Future Resident and Hypothetical Unrestricted Use	Sources
Body Weight - adult	kg	70	ah
Body Weight - child	kg	15	bh
Carcinogenic Averaging Time	yrs	70	ah
Noncarcinogenic Averaging Time	yrs	30*	bh
Dermal Exposure Time - Adult	hr/day	0.25	c
Dermal Exposure Time - Child	hr/day	0.33	c
Exposure Frequency	day/yr	350	bh
Exposure Duration - Adult	yrs	24*	bh
Exposure Duration - Child	yrs	6*	bh
Groundwater Ingestion Rate - Adult	L/day	2.0	ah
Groundwater Ingestion Rate - Child	L/day	1.0	d
Age-Adjusted Groundwater Ingestion Rate	L-yr/kg-day	1.09	e
Age-Adjusted Groundwater Ingestion Rate (mutagen)	L-yr/kg-day	3.39	e
Skin Surface Area - Adult	cm^2/day	18,000	f
Skin Surface Area - Child	cm^2/day	6,600	f
Dermal permeability coefficient	cm/hour	Chemical-specific	f
Correction factor	L/cm^3	0.001	--
Age-Adjusted Dermal Factor	cm^2-yr/kg-day	2,414	g
Age-Adjusted Dermal Factor (mutagen)	cm^2-yr/kg-day	3,057	e
Inhalation Exposure Time	hr/day	24	b
Volatilization Factor	L/m^3	0.5	e

Note: Some exposure assumptions presented here deviate from those specified in the 2007 Human Health and Ecological Risk Assessment Work Plan to include the most current default values from EPA guidances.

Source:

a. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part A, Interim Final. Office of Emergency and Remedial Response. EPA/540/1-89/002 (EPA, 1989).

b. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER Directive 9285.6-03. (EPA, 1991).

c. Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B. Office of Health and Environmental Assessment, Washington, D.C. (EPA, 1992).

d. Exposure Factors Handbook Volume I General Factors. EPA/600/P-95/002Fa. August 1997.

e. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, (Part B, Development of Risk-Based Preliminary Remediation Goals). EPA/540/R-92/003. Publication 9285.7-01B. (EPA 1991). For mutagens, see Regional Screening Levels User's Guide (EPA, May 2010) http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm

f. Exhibit 3-2 of Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005. OSWER 9285.7-02EP (EPA, 2004).

g. Equation 3.21 of Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005. OSWER 9285.7-02EP (EPA, 2004).

h. Table 1 of Risk Assessment Procedures Manual (ADEC, 2009)

* The default exposure duration was conservatively used, even though the reasonable maximum residence time at Fort Wainwright is about 8 years.

TABLE 7-3
U.S. Environmental Protection Agency Weight-of-Evidence Classification System for Carcinogenicity

Group	Description
A	Human carcinogen, based on evidence from epidemiological studies
B1 or B2	Probable human carcinogen
	B1 indicates that limited human data are available.
	B2 indicates sufficient evidence in animals and inadequate or no evidence in humans.
C	Possible human carcinogen, based on limited evidence in animals
D	Not classifiable as to human carcinogenicity
E	Evidence of noncarcinogenicity for humans

Source: *U.S. Environmental Protection Agency, Guidelines for Carcinogen Risk Assessment* (USEPA, 1986)

TABLE 7-4
Toxicity Factors Used for the Human Health Risk Assessment
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Detected analytes	CAS#	Class	Mutagen	Volatilization Factor (VF)	Oral Slope Factor (SFo) (mg/kg-day)-1	Key	Inhalation Unit Risk (IUR) (ug/m3)-1	Key	Oral Reference Dose (RfDo) (mg/kg-day)	Key	Inhalation Reference Concentration (RfC) (mg/m3)	Key	GI Absorption Factor (ABSgi)	Dermal Absorption Factor (ABSd)	Notes (CAS #)
1,1,1-Trichloroethane	71-55-6	VOC		1.8E+03					2.0E+00	I	5.0E+00	I	1		
1,1,1,2-Tetrachloroethane	630-20-6	VOC		6.1E+03	2.6E-02	I	7.4E-06	I	3.0E-02	I			1		
1,1,2,2-Tetrachloroethane	79-34-5	VOC		1.6E+04	2.0E-01	I	5.8E-05	I	4.0E-03	P			1		
1,1,2-Trichloroethane	79-00-5	VOC		7.8E+03	5.7E-02	I	1.6E-05	I	4.0E-03	I			1		
1,1-Dichloroethane	75-34-3	VOC		2.2E+03	5.7E-03	C	1.6E-06	C	2.0E-01	P	2.4E+00	A	1		
1,1-Dichloroethene	75-35-4	VOC		1.2E+03					5.0E-02	I	2.0E-01	I	1		
1,2,3-Trichlorobenzene	87-61-6	VOC		3.5E+04					8.0E-04	X			1	0.1	
1,2,3-Trichloropropane	96-18-4	VOC	M	1.7E+04	3.0E+01	I			4.0E-03	I	3.0E-04	I	1		
1,2,4-Trichlorobenzene	120-82-1	VOC		3.2E+04	2.9E-02	P			1.0E-02	I	2.0E-03	P	1		
1,2,4-Trimethylbenzene	95-63-6	VOC		8.5E+03					7.0E-03	P	6.0E-03	P	1		1,3,5 isomer as surragate for inhalation (108-67-8)
1,2-Dibromo-3-chloropropane	96-12-8	VOC	M	3.4E+04	8.0E-01	P	6.0E-03	P	2.0E-04	P	2.0E-04	I	1		
1,2-Dibromoethane	106-93-4	VOC		9.3E+03	2.0E+00	I	6.0E-04	I	9.0E-03	I	9.0E-03	I	1		
1,2-Dichlorobenzene	95-50-1	VOC		1.3E+04					9.0E-02	I	2.0E-01	H	1		
1,2-Dichloroethane	107-06-2	VOC		4.9E+03	9.1E-02	I	2.6E-05	I	2.0E-02	P	2.4E+00	A	1		
1,2-Dichloropropane	78-87-5	VOC		3.9E+03	3.6E-02	C	1.0E-05	C	9.0E-02	A	4.0E-03	I	1		
1,3,5-Trimethylbenzene	108-67-8	VOC		7.1E+03					1.0E-02	X	6.0E-03	P	1		
1,3,5-Trinitrobenzene	99-35-4	SVOC							3.0E-02	I			1	0.019	
1,3-Dichlorobenzene	541-73-1	VOC		1.1E+04					9.0E-02	I	2.0E-01	H	1		1,2-Dichlorobenzene as surrogate (95-50-1)
1,3-dichloropropene	542-75-6	VOC		3.7E+03	1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	1		
1,3-Dinitrobenzene	99-65-0	SVOC							1.0E-04	I			1	0.1	
1,4-Dichlorobenzene	106-46-7	VOC		1.1E+04	5.4E-03	C	1.1E-05	C	7.0E-02	A	8.0E-01	I	1		
1-Methylnaphthalene	90-12-0	PAH		6.3E+04	2.9E-02	P			7.0E-02	A			1		
2,4,5-Trichlorophenol	95-95-4	SVOC							1.0E-01	I			1	0.1	
2,4,5-Trichlorophenoxyacetic Acid	93-76-5	SVOC							1.0E-02	I			1	0.1	
2,4,6-Trichlorophenol	88-06-2	SVOC			1.1E-02	I	3.1E-06	I	1.0E-03	P			1	0.1	
2,4,6-Trinitrotoluene	118-96-7	SVOC			3.0E-02	I			5.0E-04	I			1	0.032	
2,4-Dichlorophenol	120-83-2	SVOC							3.0E-03	I			1	0.1	
2,4-Dichlorophenoxy Acetic Acid	94-75-7	HERB							1.0E-02	I			1	0.05	
2,4-Dinitrophenol	51-28-5	SVOC							2.0E-03	I			1	0.1	
2,4-Dinitrotoluene	121-14-2	SVOC			3.1E-01	C	8.9E-05	C	2.0E-03	I			1	0.102	
2,6-Dinitrotoluene	606-20-2	SVOC							1.0E-03	P			1	0.099	
2-Amino-4,6-dinitrotoluene	35572-78-2	SVOC							2.0E-03	S			1	0.006	
2-Butanone (MEK)	78-93-3	VOC		1.3E+04					6.0E-01	I	5.0E+00	I	1		
2-Chloronaphthalene	91-58-7	VOC		8.6E+04					8.0E-02	I			1		
2-Chlorophenol	95-57-8	VOC		1.3E+05					5.0E-03	I			1		
2-Hexanone	591-78-6	VOC		1.4E+04					5.0E-03	I	3.0E-02	I	1		
2-Methyl Butane	92046-46-3	VOC		2.7E+00							1.0E+00	P	1		n-Pentane as surrogate (109-66-0)
2-Methyl-1-propanol	78-83-1	VOC		3.0E+04					3.0E-01	I			1		(Isobutyl Alcohol)
2-Methylnaphthalene	91-57-6	PAH		6.2E+04					4.0E-03	I			1		
2-Methylpentane	107-83-5	VOC		3.2E+00							1.0E+00	P	1		n-Pentane as surrogate (109-66-0)
2-Methylphenol (o-Cresol)	95-48-7	SVOC							5.0E-02	I	6.0E-01	C	1	0.1	
2-Nitroaniline	88-74-4	SVOC							1.0E-02	X	5.0E-05	X	1	0.1	
2-Nitrophenol	88-75-5	SVOC							2.0E-03	I			1	0.1	2,4-Dinitrophenol as surrogate (51-28-5)
2-Nitrotoluene	88-72-2	VOC		1.5E+05	2.2E-01	P			9.0E-04	P			1		
3,3'-Dichlorobenzidine	91-94-1	SVOC			4.5E-01	I	3.4E-04	C					1	0.1	
3-Nitrotoluene	99-08-1	SVOC							1.0E-04	X			1	0.1	
4-(2,4-Dichlorophenoxy)butyric Acid	94-82-6	HERB							8.0E-03	I			1	0.1	
4,4'-DDD	72-54-8	PEST			2.4E-01	I	6.9E-05	C					1	0.1	
4,4'-DDE	72-55-9	PEST			3.4E-01	I	9.7E-05	C					1	0.1	

TABLE 7-4
Toxicity Factors Used for the Human Health Risk Assessment
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Detected analytes	CAS#	Class	Mutagen	Volatilization Factor (VF)	Oral Slope Factor (SFo) (mg/kg-day)-1	Key	Inhalation Unit Risk (IUR) (ug/m3)-1	Key	Oral Reference Dose (RfDo) (mg/kg-day)	Key	Inhalation Reference Concentration (RfC) (mg/m3)	Key	GI Absorption Factor (ABSgi)	Dermal Absorption Factor (ABSd)	Notes (CAS #)
4,4'-DDT	50-29-3	PEST			3.4E-01	I	9.7E-05	I	5.0E-04	I			1	0.03	
4-Amino-2,6-dinitrotoluene	19406-51-0	SVOC							2.0E-03	S			1	0.009	
4-Bromophenyl phenyl ether	101-55-3	SVOC			1.0E-04	I							1	1.00E-01	Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47) as surrogate (543
4-Chloro-3-methylphenol	59-50-7	SVOC							1.0E-01	X			1	0.1	
4-Chloroaniline	106-47-8	SVOC			2.0E-01	P			4.0E-03	I			1	0.1	
4-Chlorophenyl phenyl ether	7005-72-3	SVOC			1.0E-04	I							1	1.00E-01	Tetrabromodiphenyl ether, 2,2',4,4'- (BDE-47) as surrogate (543
4-Chlorotoluene	106-43-4	VOC		7.9E+03					7.0E-02	P			1		
4-Isopropyltoluene	99-87-6	VOC		6.7E+03					1.0E-01	I	4.0E-01	I	1		Cumene as surrogate (98-82-8)
4-Methyl-2-pentanone (MIBK)	108-10-1	VOC		1.1E+04					8.0E-02	H	3.0E+00	I	1		
4-Methylphenol (p-Cresol)	106-44-5	SVOC							5.0E-03	H	6.0E-01	C	1	0.1	
4-Nitroaniline	100-01-6	SVOC			2.0E-02	P			4.0E-03	P	6.0E-03	P	1	0.1	
4-Nitrophenol	100-02-7	SVOC							2.0E-03	I			1	0.1	2,4-Dinitrophenol as surrogate (51-28-5)
4-Nitrotoluene	99-99-0	VOC			1.6E-02	P			4.0E-03	P			1	0.1	
Acenaphthene	83-32-9	PAH		1.5E+05					6.0E-02	I			1	0.13	
Acenaphthylene	208-96-8	PAH		1.5E+05					6.0E-02	I			1	0.13	Acenaphthene as surrogate (83-32-9)
Acetone	67-64-1	VOC		1.5E+04					9.0E-01	I	3.1E+01	A	1		
Aldrin	309-00-2	PEST			1.7E+01	I	4.9E-03	I	3.0E-05	I			1	0.1	
alpha-Chlordane	5103-71-9	PEST			3.5E-01	I	1.0E-04	I	5.0E-04	I	7.0E-04	I	1	0.04	Chlordane as surrogate (12789-03-6)
Alpha-Hexachlorocyclohexane	319-84-6	SVOC			6.3E+00	I	1.8E-03	I	8.0E-03	A			1	0.1	
Aluminum	7429-90-5	Metal							1.0E+00	P	5.0E-03	P	1		
Anthracene	120-12-7	PAH		5.6E+05					3.0E-01	I			1	0.13	
Antimony	7440-36-0	Metal							4.0E-04	I			0.15		
Arsenic	7440-38-2	Metal			1.5E+00	I	4.3E-03	I	3.0E-04	I	1.5E-05	C	1	0.03	
Barium	7440-39-3	Metal							2.0E-01	I	5.0E-04	H	0.07		
Benzene	71-43-2	VOC		3.8E+03	5.5E-02	I	7.8E-06	I	4.0E-03	I	3.0E-02	I	1		
Benzo(a)anthracene	56-55-3	PAH	M		7.3E-01	E	1.1E-04	C					1	0.13	
Benzo(a)pyrene	50-32-8	PAH	M		7.3E+00	I	1.1E-03	C					1	0.13	
Benzo(b)fluoranthene	205-99-2	PAH	M		7.3E-01	I	1.1E-04	C					1	0.13	
Benzo(ghi)perylene	191-24-2	VOC		2.6E+06					3.0E-02	I			1	0.13	Pyrene as surrogate (129-00-0)
Benzo(k)fluoranthene	207-08-9	PAH	M		7.3E-02	E	1.1E-04	C					1	0.13	
Benzoic acid	65-85-0	SVOC							4.0E+00	I			1	0.1	
Benzyl alcohol	100-51-6	SVOC							1.0E-01	P			1	0.1	
Benzyl butyl phthalate	85-68-7	SVOC			1.9E-03	P			2.0E-01	I			1	0.1	
Beryllium	7440-41-7	Metal					2.4E-03	I	2.0E-03	I	2.0E-05	I	0.007		
Beta-Hexachlorocyclohexane	319-85-7	SVOC			1.8E+00	I	5.3E-04	I					1	0.1	
bis(2-Chloroethoxy)methane	111-91-1	SVOC							3.0E-03	P			1	0.1	
bis(2-Chloroethyl)ether	111-44-4	VOC		4.6E+04	1.1E+00	I	3.3E-04	I					1		
bis(2-Chloroisopropyl)ether	108-60-1	VOC		3.8E+04	7.0E-02	H	1.0E-05	H	4.0E-02	I			1		(Bis(2-chloro-1-methylethyl) ether)
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC			1.4E-02	I	2.4E-06	C	2.0E-02	I			1	0.1	
Bismuth	7440-69-9														
Boron	7440-42-8	Metal							2.0E-01	I	2.0E-02	H	1		
Bromodichloromethane	75-27-4	VOC		4.3E+03	6.2E-02	I	3.7E-05	C	2.0E-02	I			1		
Bromoform	75-25-2	SVOC			7.9E-03	I	1.1E-06	I	2.0E-02	I			1	0.1	
Bromobenzene	108-86-1	VOC		9.0E+03					8.0E-03	I	6.0E-02	I	1		
Bromomethane	74-83-9	VOC		1.5E+03					1.4E-03	I	5.0E-03	I	1		
Butanal	123-72-8								1.0E-01	I			1	0.1	N-Butanol as surrogate (71-36-3)
C10-C12 Aliphatics		TPH													
C10-C12 Aromatics		TPH													
C12-C16 Aliphatics		TPH													

TABLE 7-4
Toxicity Factors Used for the Human Health Risk Assessment
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Detected analytes	CAS#	Class	Mutagen	Volatilization Factor (VF)	Oral Slope Factor (SFo) (mg/kg-day)-1	Key	Inhalation Unit Risk (IUR) (ug/m3)-1	Key
C12-C16 Aromatics		TPH						
C16-C21 Aliphatics		TPH						
C16-C21 Aromatics		TPH						
C21-C34 Aliphatics		TPH						
C21-C34 Aromatics		TPH						
C8-C10 Aromatics		TPH						
Cadmium (soil)	7440-43-9	Metal					1.8E-03	I
Cadmium (water)	7440-43-9	Metal					1.8E-03	I
Carbazole	86-74-8	SVOC			2.0E-02	H		
Carbon disulfide	75-15-0	VOC		1.3E+03				
Carbon tetrachloride	56-23-5	VOC		1.6E+03	1.3E-01	I	1.5E-05	I
Chlorobenzene	108-90-7	VOC		6.9E+03				
Chloroethane	75-00-3	VOC		1.4E+03				
Chloroform	67-66-3	VOC		2.8E+03	3.1E-02	C	2.3E-05	I
Chloromethane	74-87-3	VOC		1.3E+03				
Chromium (assume VI)	7440-47-3	Metal	M				8.4E-02	I
Chrysene	218-01-9	PAH	M		7.3E-03	E	1.1E-05	C
cis-1,2-Dichloroethene	156-59-2	VOC		2.7E+03				
cis-1,3-dichloropropene	10061-01-5	VOC		3.7E+03	1.0E-01	I	4.0E-06	I
Cobalt	7440-48-4	Metal					9.0E-03	P
Copper	7440-50-8	Metal						
Cyclopentane	287-92-3	VOC		3.0E+00				
Dalapon	75-99-0	HERB						
Delta-Hexachlorocyclohexane	319-86-8	SVOC			1.8E+00	I	5.3E-04	I
Dibenzo(a,h)anthracene	53-70-3	PAH	M		7.3E+00	E	1.2E-03	C
Dibenzofuran	132-64-9	VOC		2.1E+05				
Dibromochloromethane	124-48-1	VOC		8.6E+03	8.4E-02	I	2.7E-05	C
Dicamba	1918-00-9	HERB						
Dichlorodifluoromethane	75-71-8	VOC		9.0E+02				
Dieldrin	60-57-1	PEST			1.6E+01	I	4.6E-03	I
Diethyl phthalate	84-66-2	SVOC						
Dimethyl phthalate	131-11-3	SVOC						
Di-n-butyl phthalate	84-74-2	SVOC						
Di-n-octyl phthalate	117-84-0	SVOC						
Dinoseb	88-85-7	HERB						
DRO								
Endosulfan I	959-98-8	PEST						
Endosulfan II	33213-65-9	PEST						
Endosulfan sulfate	1031-07-8	PEST						
Endrin	72-20-8	PEST						
Endrin aldehyde	7421-93-4	PEST						
Endrin ketone	53494-70-5	PEST						
Ethane, 1,1-difluoro-	75-37-6	VOC		1.2E+03				
Ethylbenzene	100-41-4	VOC		6.1E+03	1.1E-02	C	2.5E-06	C
Fluoranthene	206-44-0	PAH						
Fluorene	86-73-7	PAH		3.0E+05				
Fluoride	16984-48-8	INORG						
gamma-Chlordane	5566-34-7	PEST			3.5E-01	I	1.0E-04	I
gamma-Hexachlorocyclohexane (Lindane)	58-89-9	PEST			1.1E+00	C	3.1E-04	C

Detected analytes	Oral Reference Dose (RfDo) (mg/kg-day)	Key	Inhalation Reference Concentration (RfC) (mg/m3)	Key	GI Absorption Factor (ABSgi)	Dermal Absorption Factor (ABSd)	Notes (CAS #)
C12-C16 Aromatics							
C16-C21 Aliphatics							
C16-C21 Aromatics							
C21-C34 Aliphatics							
C21-C34 Aromatics							
C8-C10 Aromatics							
Cadmium (soil)	1.0E-03	I	1.0E-05	A	0.025	0.001	
Cadmium (water)	5.0E-04	I	1.0E-05	A	0.050	0.001	
Carbazole					1		
Carbon disulfide	1.0E-01	I	7.0E-01	I	1		
Carbon tetrachloride	7.0E-04	I	1.9E-01	A	1		
Chlorobenzene	2.0E-02	I	5.0E-02	P	1		
Chloroethane			1.0E+01	I	1		(Ethyl Chloride)
Chloroform	1.0E-02	I	9.8E-02	A	1		
Chloromethane			9.0E-02	I	1		
Chromium (assume VI)	3.0E-03	I	1.0E-04	I	0.025		Chromium(VI) as surrogate (18540-29-9)
Chrysene					1	0.13	
cis-1,2-Dichloroethene	1.0E-02	P			1		
cis-1,3-dichloropropene	3.0E-02	I	2.0E-02	I	1		1,3-Dichloropropene as surrogate (542-75-6)
Cobalt	3.0E-04	P	6.0E-06	P	1		
Copper	4.0E-02	H			1		
Cyclopentane			6.0E+00	I	1		Cyclohexane as surrogate (110-82-7)
Dalapon	3.0E-02	I			1	0.1	
Delta-Hexachlorocyclohexane					1	0.1	Beta-Hexachlorocyclohexane as surrogate (319-85-7)
Dibenzo(a,h)anthracene					1	0.13	
Dibenzofuran	1.0E-03	X			1		
Dibromochloromethane	2.0E-02	I			1	0.1	
Dicamba	3.0E-02	I			1	0.1	
Dichlorodifluoromethane	2.0E-01	I	2.0E-01	H	1		
Dieldrin	5.0E-05	I			1	0.1	
Diethyl phthalate	8.0E-01	I			1	0.1	
Dimethyl phthalate	8.0E-01	I			1	0.1	Diethyl phthalate as surrogate (84-66-2)
Di-n-butyl phthalate	1.0E-01	I			1	0.1	
Di-n-octyl phthalate	1.0E-01	I			1	0.1	Di-n-butyl phthalate as surrogate (84-74-2)
Dinoseb	1.0E-03	I			1	0.1	
DRO							
Endosulfan I	6.0E-03	I			1	0.1	Endosulfan as surrogate (115-29-7)
Endosulfan II	6.0E-03	I			1	0.1	Endosulfan as surrogate (115-29-7)
Endosulfan sulfate	6.0E-03	I			1	0.1	Endosulfan as surrogate (115-29-7)
Endrin	3.0E-04	I			1	0.1	
Endrin aldehyde	3.0E-04	I			1	0.1	Endrin as surrogate (72-20-8)
Endrin ketone	3.0E-04	I			1	0.1	Endrin as surrogate (72-20-8)
Ethane, 1,1-difluoro-			4.0E+01	I	1		
Ethylbenzene	1.0E-01	I	1.0E+00	I	1		
Fluoranthene	4.0E-02	I			1	0.13	
Fluorene	4.0E-02	I			1	0.13	
Fluoride	4.0E-02	C	1.3E-02	C	1		
gamma-Chlordane	5.0E-04	I	7.0E-04	I	1	0.04	Chlordane as surrogate (12789-03-6)
gamma-Hexachlorocyclohexane (Lindane)	3.0E-04	I			1	0.04	

TABLE 7-4
Toxicity Factors Used for the Human Health Risk Assessment
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Detected analytes	CAS#	Class	Mutagen	Volatilization Factor (VF)	Oral Slope Factor (SFo) (mg/kg-day)-1	Key	Inhalation Unit Risk (IUR) (ug/m3)-1	Key	Oral Reference Dose (RfDo) (mg/kg-day)	Key	Inhalation Reference Concentration (RfC) (mg/m3)	Key	GI Absorption Factor (ABSgi)	Dermal Absorption Factor (ABSd)	Notes (CAS #)
GRO															
Heptachlor	76-44-8	PEST			4.5E+00	I	1.3E-03	I	5.0E-04	I			1	0.1	
Heptachlor epoxide	1024-57-3	PEST			9.1E+00	I	2.6E-03	I	1.3E-05	I			1	0.1	
Heptanal	111-71-7														
Hexachlorobenzene	118-74-1	SVOC			1.6E+00	I	4.6E-04	I	8.0E-04	I			1	0.1	
Hexachlorobutadiene	87-68-3	SVOC			7.8E-02	I	2.2E-05	I	1.0E-03	P			1	0.1	
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	Explosive			1.1E-01	I			3.0E-03	I			1	0.015	
Hexane	110-54-3	VOC		8.9E+02					6.0E-02	H	7.0E-01	I	1		
Indeno(1,2,3-cd)pyrene	193-39-5	PAH	M		7.3E-01	E	1.1E-04	C					1	0.13	
Iron	7439-89-6	Metal							7.0E-01	P			1		
Isophorone	78-59-1	SVOC			9.5E-04	I			2.0E-01	I	2.0E+00	C	1	0.1	
Isopropylbenzene	98-82-8	VOC		6.7E+03					1.0E-01	I	4.0E-01	I	1		(Cumene)
Lead	7439-92-1	Metal											1		ADEC Table B1 value
m,p-Xylene	108-38-3/1	VOC		5.9E+03					2.0E-01	I	1.0E-01	I	1		Total xylene mixture as surrogate (1330-20-7)
Manganese (soil)	7439-96-5	Metal							1.4E-01	I	5.0E-05	I	1		
Manganese (water)	7439-96-5	Metal							2.4E-02	I	5.0E-05	I	0.04		
MCPA (2-Methyl-4-chlorophenoxy acetic acid)	94-74-6	HERB							5.0E-04	I			1	0.1	
MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	93-65-2	HERB							1.0E-03	I			1	0.1	
Mercury	7487-94-7	Metal							3.0E-04	I	3.0E-05	C	0.07		Mercury chloride as surrogate (7487-94-7)
Methoxychlor	72-43-5	PEST							5.0E-03	I			1	0.1	
Methyl iodide	74-88-4	VOC		1.6E+03							9.0E-02	I	1		Chloromethane as surrogate (74-87-3)
Methylcyclopentane	96-37-7	VOC		3.4E+00							6.0E+00	I	1		Cyclohexane as surrogate (110-82-7)
Methylene chloride	75-09-2	VOC		2.4E+03	7.5E-03	I	4.7E-07	I	6.0E-02	I	1.0E+00	A	1		
Methyl-tert-butyl ether (MTBE)	1634-04-4	VOC		5.3E+03	1.8E-03	C	2.6E-07	C			3.0E+00	I	1		
Molybdenum	7439-98-7	Metal							5.0E-03	I			1		
Naphthalene	91-20-3	PAH		5.0E+04			3.4E-05	C	2.0E-02	I	3.0E-03	I	1	0.13	
n-Butylbenzene	104-51-8	VOC		4.4E+00					1.0E-01	X	1.0E+00	X	1	0.1	Propyl benzene as surrogate (103-65-1)
Nickel	7440-02-0	Metal					2.6E-04	C	2.0E-02	I	9.0E-05	A	0.04		
Nitrobenzene	98-95-3	VOC		7.9E+04			4.0E-05	I	2.0E-03	I	9.0E-03	I	1		
Nitrogen, Nitrate (as N)	14797-55-8	INORG							1.6E+00	I			1		
Nitrogen, Nitrate-Nitrite	14797-65-0	INORG							1.0E-01	I			1		(Nitrate)
Nitroglycerin	55-63-0	Explosive			1.7E-02	P			1.0E-04	P			1	0.1	
N-Nitrosodimethylamine	62-75-9	SVOC	M		5.1E+01	I	1.4E-02	I	8.0E-06	P	4.0E-05	X	1	0.1	
N-Nitrosodi-n-propylamine	621-64-7	SVOC			7.0E+00	I	2.0E-03	C					1	0.1	
N-Nitrosodiphenylamine	86-30-6	SVOC			4.9E-03	I	2.6E-06	C					1	0.1	
n-Propylbenzene	103-65-1	VOC		7.5E+03					1.0E-01	X	1.0E+00	X	1	0.1	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	Explosive							5.0E-02	I			1	0.006	
o-Xylene	95-47-6	VOC		7.0E+03					2.0E-01	I	7.0E-01	C	1		
PCB-1254 (Aroclor 1254)	11097-69-1	PCB			2.0E+00	I	5.7E-04	I	2.0E-05	I			1	0.14	
PCB-1260 (Aroclor 1260)	11096-82-5	PCB			2.0E+00	I	5.7E-04	I	2.0E-05	I			1	0.14	
PCBs (total)	1336-36-3	PCB			2.0E+00	I	5.7E-04	C	2.0E-05	I			1	0.14	PCB-1254 as surrogate (11097-69-1)
Pentachlorophenol	87-86-5	SVOC			1.2E-01	I	5.1E-06	C	3.0E-02	I			1	0.25	
Pentaerythritol tetranitrate	78-11-5	Explosive							5.0E-02	I			1	0.006	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX) as surrogate (2
Pentane	109-66-0	VOC		8.4E+02							1.0E+00	P			
Phenanthrene	85-01-8	PAH		4.5E+00					3.0E-01	I			1	0.13	Anthracene as surrogate (120-12-7)
Phenol	108-95-2	SVOC							3.0E-01	I	2.0E-01	C	1	0.1	
Propanal (Propionaldehyde)	123-38-6	VOC		9.6E+03							8.0E-03	I			
Propene (Propylene)	115-07-1										3.0E+00	C			
Pyrene	129-00-0	VOC		2.6E+06					3.0E-02	I			1	0.13	

TABLE 7-4
Toxicity Factors Used for the Human Health Risk Assessment
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Detected analytes	CAS#	Class	Mutagen	Volatilization Factor (VF)	Oral Slope Factor (SFo) (mg/kg-day)-1	Key	Inhalation Unit Risk (IUR) (ug/m3)-1	Key	Oral Reference Dose (RfDo) (mg/kg-day)	Key	Inhalation Reference Concentration (RfC) (mg/m3)	Key	GI Absorption Factor (ABSgi)	Dermal Absorption Factor (ABSd)	Notes (CAS #)
RRO															
sec-Butylbenzene	135-98-8	VOC		4.6E+00					1.0E-01	X	1.0E+00	X	1	0.1	Propyl benzene as surrogate (103-65-1)
Selenium	7782-49-2	Metal							5.0E-03	I	2.0E-02	C	1		
Silver	7440-22-4	Metal							5.0E-03	I			0.04		
Strontium	7440-24-6	Metal							6.0E-01	I			1		
Styrene	100-42-5	VOC		1.0E+04					2.0E-01	I	1.0E+00	I	1		
tert-Butylbenzene	98-06-6	VOC		4.1E+00					1.0E-01	X	1.0E+00	X	1	0.1	Propyl benzene as surrogate (103-65-1)
Tetrachloroethene (PCE)	127-18-4	VOC		2.5E+03	5.4E-01	C	5.9E-06	C	1.0E-02	I	2.7E-01	A	1		
Thallium	7440-28-0	Metal							8.0E-05	D			1		
Toluene	108-88-3	VOC		4.6E+03					8.0E-02	I	5.0E+00	I	1		
Toxaphene	8001-35-2	PEST			1.1E+00	I	3.2E-04	I					1	0.1	
trans-1,2-Dichloroethene	156-60-5	VOC		2.7E+03					2.0E-02	I	6.0E-02	P	1		
trans-1,3-Dichloropropene	10061-02-6	VOC		3.7E+03	1.0E-01	I	4.0E-06	I	3.0E-02	I	2.0E-02	I	1		1,3-Dichloropropene as surrogate (542-75-6)
Trichloroethene (TCE) - ADEC	79-01-6	VOC		2.4E+03	4.0E-01	D	1.1E-04	D	3.0E-04	D	4.0E-02	D	1		
Trichloroethene (TCE) - USEPA	79-01-6	VOC		2.4E+03	5.0E-02	U	4.0E-06	U	4.0E-04	U	5.0E-03	U	1		
Trichlorofluoromethane	75-69-4	VOC		1.1E+03					3.0E-01	I	7.0E-01	H	1		(Freon 11)
Vanadium	7440-62-2	Metal							5.0E-03	S			1		(Vanadium and compounds)
Vinyl chloride	75-01-4	VOC	M	1.0E+03	7.2E-01	I	4.4E-06	I	3.0E-03	I	1.0E-01	I	1		
Xylenes, Total	1330-20-7	VOC		6.3E+03					2.0E-01	I	1.0E-01	I	1		
Zinc	7440-66-6	Metal							3.0E-01	I			1		

Sources from Regional Screening Level Table (RSL) Master December 2009
A= ATSDR
C= Cal EPA
E= Environmental Criteria and Assessment Office
H= HEAST
I= IRIS
M= mutagen
P= PPRTV
S= See User Guide Section 5
X= PPRTV Appendix
Other sources
D= ADEC 18 AAC 75
U= USEPA 2009 Draft Toxicological Review of Trichloroethylene
VFs= Calculated using EPAs equation and default parameters
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm
Highlighted VFs from ChemID Plus through NLM's Toxnet Database
Methyl iodide VF calculated using Bedan's tables and RAIS database physical/chemical parameters.

TABLE 7-5
Summary of Risk and Hazard Estimates for Non-Residential Exposure Scenarios
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Exposure Scenario	Exposure Route	Excess Lifetime Cancer Risk	Noncancer Hazard Index	Primary Contributors [a]
Future Maintenance Worker - Direct Contact with Soil (0-2 ft bgs)	Ingestion	3x10-6	0.4	None identified
	Dermal	6x10-7	0.06	
	Inhalation	3x10-7	0.05	
	Total	3x10-6	0.5	
Future Excavation Worker - Direct Contact with Soil (0-15 ft bgs)	Ingestion	1x10-6	0.7	None identified
	Dermal	2x10-7	0.05	
	Inhalation	6x10-8	0.008	
	Total	2x10-6	0.7	
Future Recreational/Site Visitor - Direct Contact with Soil (0-2 ft bgs)	Ingestion	2x10-6	0.2	None identified
	Dermal	2x10-7	0.01	
	Inhalation	2x10-7	0.02	
	Total	3x10-6	0.2	

Notes:

a. Primary contributors to the total risk are listed when ELCR > 10^{-5} or HI > 1.0.

ELCR = Excess lifetime cancer risk

HI = Hazard index

TABLE 7-6

Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-A-EXBLD22-23-0_5	8E-06	0.2	None identified	None identified
06DP02S01	5E-06	0.3	None identified	None identified
07FW-E-EX52-W104A	3E-06	0.2	None identified	None identified
07FW-E-EXSB105-F505	3E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-17-0_2	3E-06	0.2	None identified	None identified
08-FW-E-EXPLG W101FD	3E-06	0.2	None identified	None identified
07FW-E-EXSB105-F504	3E-06	0.2	None identified	None identified
07FW-E-EX52-W803A	3E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-12-0_2	2E-06	0.2	None identified	None identified
08-FW-C-EXBLD01-01-2	2E-06	0.2	None identified	None identified
07FW-E-EX52-W801A	2E-06	0.1	None identified	None identified
08-FW-D-EXAREAD-13-0_2	2E-06	0.2	None identified	None identified
08-FW-A-SS58-1-2B	2E-06	0.2	None identified	None identified
07FWCDSS01-01	2E-06	0.5	None identified	None identified
07FWCDSS01-03FD	2E-06	0.4	None identified	None identified
08-FW-A-EXBLD15-32-0_2	2E-06	0.3	None identified	None identified
08-FW-E-SS77-0-2	2E-06	0.3	None identified	None identified
08-FW-E-EXPLG W203	2E-06	0.1	None identified	None identified
07FW-A-EXBLD48-40	2E-06	0.2	None identified	None identified
07FW-E-EX52-W415A	2E-06	0.1	None identified	None identified
07FW-A-EXBld48-49	2E-06	0.2	None identified	None identified
08-FW-E-SPORG-01-0_5	2E-06	0.3	None identified	None identified
07FWCDSS01-02	2E-06	0.3	None identified	None identified
08-FW-A-SS09-0-2	2E-06	0.3	None identified	None identified
08-FW-A-SS30-0-2	2E-06	0.3	None identified	None identified
08-FW-C-EXBLD01-15-2B	2E-06	0.2	None identified	None identified
08-FW-C-EXBLD01-10-2	2E-06	0.2	None identified	None identified
08-FW-A-SS14-0-2	1E-06	0.2	None identified	None identified
08-FW-E-EXPLG W201	1E-06	0.09	None identified	None identified
08-FW-A-EXBLD22-24-0_5	1E-06	0.2	None identified	None identified
08-FW-E-SS72-0-2	1E-06	0.3	None identified	None identified
08-FW-B-SS04-0_2	1E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-05-0_2	1E-06	0.2	None identified	None identified
08-FW-A-SS11-0-2	1E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-31-0_2	1E-06	0.3	None identified	None identified
08-FW-A-SS55-1-2	1E-06	0.2	None identified	None identified
08-FW-C-SSSP06-02	1E-06	0.3	None identified	None identified
08-FW-E-SPORG-02-0_5	1E-06	0.3	None identified	None identified
08-FW-E-SS78-0-2	1E-06	0.3	None identified	None identified
08-FW-D-SS62-1-2	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-09-2	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD31-04-2	1E-06	0.2	None identified	None identified
08-FW-E-SS74-0-2	1E-06	0.3	None identified	None identified
08-FW-C-SS01-0_2	1E-06	0.3	None identified	None identified
08-FW-A-SS16-0-2	1E-06	0.2	None identified	None identified
08-FW-A-SS37-0_2	1E-06	0.3	None identified	None identified
08-FW-E-SS73-0_2	1E-06	0.3	None identified	None identified
08-FW-A-SS13-0_2	1E-06	0.3	None identified	None identified
08-FW-A-SS31-0-2	1E-06	0.2	None identified	None identified
08-FW-E-SS76-0-2	1E-06	0.3	None identified	None identified
08-FW-D-EXAREAD-06-0_2	1E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-25-0_2	1E-06	0.3	None identified	None identified
06SB80S01	1E-06	0.07	None identified	None identified
08-FW-A-SS12-0-2	1E-06	0.2	None identified	None identified
06DP01S02	1E-06	0.1	None identified	None identified
08-FW-A-EXBLD22-10-2	1E-06	0.3	None identified	None identified
08-FW-E-SS71-0_2	1E-06	0.3	None identified	None identified
08-FW-A-SS35-0-2	1E-06	0.2	None identified	None identified
08-FW-D-SS63-1-2	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-08-1	1E-06	0.3	None identified	None identified

TABLE 7-6
Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)
Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-A-SSSP03-02	1E-06	0.2	None identified	None identified
08-FW-E-SS69-1-2	1E-06	0.3	None identified	None identified
08-FW-D-SS64-1_2	1E-06	0.2	None identified	None identified
08-FW-A-SS17-0-2	1E-06	0.3	None identified	None identified
08-FW-A-SS33-0-2	1E-06	0.2	None identified	None identified
08-FW-C-EXBLD01-04-2	1E-06	0.3	None identified	None identified
08-FW-A-SS57-1-2	1E-06	0.3	None identified	None identified
08-FW-D-SS59-1-2	1E-06	0.2	None identified	None identified
08-FW-C-EXBLD01-03-2	1E-06	0.2	None identified	None identified
08-FW-C-SSSP06-01	1E-06	0.2	None identified	None identified
08-FW-C-SS02-0_2	1E-06	0.3	None identified	None identified
08-FW-E-SS68-1-2	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-06-2	1E-06	0.3	None identified	None identified
08-FW-A-SS36-0-2	1E-06	0.2	None identified	None identified
08FWAMW78-01-1_2	1E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-07-0_2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-19-1_2	1E-06	0.2	None identified	None identified
08-FW-E-SS42-0_2	1E-06	0.3	None identified	None identified
08-FW-E-SS75-0-2	1E-06	0.3	None identified	None identified
08-FW-C-EXBLD01-02-2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD22-07-1	1E-06	0.3	None identified	None identified
08-FW-C-SS03-0_2	1E-06	0.2	None identified	None identified
08-FW-B-SS26-0-2	1E-06	0.3	None identified	None identified
08-FW-A-SS54-1-2	1E-06	0.2	None identified	None identified
07FW-A-EXBld48-41	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD26-03-2	1E-06	0.3	None identified	None identified
08-FW-E-EXPLG W104	1E-06	0.06	None identified	None identified
08-FW-B-SS05-0_2	1E-06	0.2	None identified	None identified
08-FW-A-SS18-0-2	1E-06	0.3	None identified	None identified
08-FW-A-SS07-0-2	1E-06	0.2	None identified	None identified
08-FW-A-SS08-0-2	1E-06	0.2	None identified	None identified
08-FW-A-SSSP03-01	1E-06	0.2	None identified	None identified
06DP04S03	1E-06	0.2	None identified	None identified
08-FW-C-SS22-0_2	1E-06	0.2	None identified	None identified
08-FW-A-SS45-0-2	1E-06	0.2	None identified	None identified
08-FW-A-SS46-0-2	1E-06	0.2	None identified	None identified
08-FW-C-EXBLD01-09-2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-38-0_2	1E-06	0.2	None identified	None identified
08-FW-A-SS48-0-2	1E-06	0.2	None identified	None identified
08-FW-A-SS53-1-2	1E-06	0.2	None identified	None identified
08-FW-B-SS27-0-2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD22-27-2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-25-0_1	9E-07	0.2	None identified	None identified
08-FW-D-SS65-1-2	9E-07	0.03	None identified	None identified
08-FW-E-SS67-0_2	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD15-37-0_2	9E-07	0.2	None identified	None identified
08FWAMW80-01-1_2B	9E-07	0.2	None identified	None identified
08-FW-B-SS25-0-2	9E-07	0.3	None identified	None identified
08-FW-C-SS24-0_2	9E-07	0.2	None identified	None identified
08-FW-C-EXBLD01-05-2	9E-07	0.1	None identified	None identified
08-FW-A-EXBLD22-21-0_5	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD31-02-2	9E-07	0.2	None identified	None identified
08-FW-B-SS20-0_2	9E-07	0.2	None identified	None identified
08-FW-E-SS66-0_2	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-25-0_5	9E-07	0.2	None identified	None identified
08-FW-A-SS28-0-2	9E-07	0.2	None identified	None identified
08-FW-A-SS32-0-2	9E-07	0.2	None identified	None identified
08-FW-A-SS56-1-2	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD24-04-1B	9E-07	0.1	None identified	None identified
08 FCS RISO BLD11 C5-2	9E-07	0.01	None identified	None identified

TABLE 7-6

Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-E-SS49-0_2	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-22-2	9E-07	0.2	None identified	None identified
08FWAMW79-01-1_2	9E-07	0.2	None identified	None identified
08-FW-A-SS51-1-2	9E-07	0.2	None identified	None identified
08-FW-A-SS52-1-2	9E-07	0.2	None identified	None identified
08-FW-A-SS06-0-2	9E-07	0.2	None identified	None identified
08-FW-B-SS19-0_2	9E-07	0.2	None identified	None identified
07FW-A-EXBLD48-42	8E-07	0.2	None identified	None identified
08-FW-A-SS10-0_2	8E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-18-0_5	8E-07	0.2	None identified	None identified
08-FW-E-SS70-0_2	8E-07	0.2	None identified	None identified
08-FW-C-SS23-0_2	8E-07	0.2	None identified	None identified
06TP22S01	8E-07	0.2	None identified	None identified
08-FW-A-SS15-0-2B	8E-07	0.2	None identified	None identified
08-FW-A-SS34-0_2	8E-07	0.2	None identified	None identified
06DP03S01	8E-07	0.2	None identified	None identified
08-FW-A-EXBLD15-60-1_2	8E-07	0.2	None identified	None identified
08-FW-D-SS61-1-2	8E-07	0.2	None identified	None identified
08-FW-D-EXAREAD-01-0_2	8E-07	0.2	None identified	None identified
08-FW-E-EXN02 W01	8E-07	0.04	None identified	None identified
08-FW-E-EXPLG W202	8E-07	0.04	None identified	None identified
08-FW-A-EXBLD26-02-1	7E-07	0.2	None identified	None identified
08-FW-D-EXAREAD-28-0_2	7E-07	0.1	None identified	None identified
08FWADB06SS-07	7E-07	0.000006	None identified	None identified
08-FW-A-EXBLD24-04-1	7E-07	0.03	None identified	None identified
08-FW-E-EXE05 F101	7E-07	0.04	None identified	None identified
08-FW-A-EXBLD22-20-0_5	7E-07	0.2	None identified	None identified
08-FW-C-EXBLD01-06-2	7E-07	0.2	None identified	None identified
08-FW-E-SS50-0_2	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-19-0_5	7E-07	0.2	None identified	None identified
08 FCS RISO BLD11 C3-1	7E-07	0.008	None identified	None identified
08-FW-A-SS47-0-2	7E-07	0.2	None identified	None identified
08-FW-E-EXN02 W02	7E-07	0.04	None identified	None identified
08-FW-D-SS60-1-2	7E-07	0.2	None identified	None identified
08FWAMW80-01-1_2	6E-07	0.06	None identified	None identified
08-FW-A-EXBLD26-01-1	6E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-26-2	6E-07	0.2	None identified	None identified
08-FW-A-MW77-0_2	6E-07	0.06	None identified	None identified
08-FW-C-EXBLD01-05-2B	5E-07	0.1	None identified	None identified
08-FW-D-SS65-1-2B	5E-07	0.2	None identified	None identified
08-FW-A-SS29-0-2	5E-07	0.1	None identified	None identified
07FW-E-EX52-W414A	4E-07	0.03	None identified	None identified
08-FW-A-EXBLD22-33-1	4E-07	0.1	None identified	None identified
07FW-E-EXSB105-F503	4E-07	0.02	None identified	None identified
08FWADB06SS-09	4E-07	0.000004	None identified	None identified
06SS12S01	3E-07	0.02	None identified	None identified
08FWADB06SS-10B	2E-07	0.000007	None identified	None identified
07FW-A-EXTSA-27	2E-07	0.01	None identified	None identified
06DP04S01	2E-07	0.02	None identified	None identified
08-FW-E-EXPLG F101	2E-07	0.01	None identified	None identified
06DP01S03	2E-07	0.07	None identified	None identified
07FW-E-EX52-W804A	2E-07	0.01	None identified	None identified
08 FCS RISO BLD11 C4-1	2E-07	0.002	None identified	None identified
08-FW-E-EXPLG F201	2E-07	0.01	None identified	None identified
08-FW-E-EXPLG W103	2E-07	0.01	None identified	None identified
08-FW-D-EXAREAD-06-0_2B	2E-07	0.004	None identified	None identified
08FWADB04SS0-07	2E-07	0.000001	None identified	None identified
08-FW-E-EXN02 F101	2E-07	0.01	None identified	None identified
08-FW-E-EXN02 W04	1E-07	0.009	None identified	None identified
08FWADB04SS0-01	1E-07	0.000001	None identified	None identified

TABLE 7-6

Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08FWADB04SS0-10B	1E-07	0.0000008	None identified	None identified
07FW-A-EXTSA-24FD	1E-07	0.008	None identified	None identified
07FW-A-EXTSA-01FD	1E-07	0.008	None identified	None identified
08FWADB06SS-03	1E-07	0.000001	None identified	None identified
08FWADB04SS0-05	1E-07	0.000001	None identified	None identified
06DP01S01	1E-07	0.1	None identified	None identified
08FWADB04SS0-06	1E-07	0.000001	None identified	None identified
06DP04S02	9E-08	0.001	None identified	None identified
08FWADB04SS0-08	9E-08	0.0000009	None identified	None identified
08-FW-A-SS58-1-2	9E-08	0.08	None identified	None identified
08-FW-B-SS20-0_2B	9E-08	0.08	None identified	None identified
08 FCS RISO BLD11 C1-1	9E-08	0.001	None identified	None identified
08-FW-A-SSEJP-01	8E-08	0.0009	None identified	None identified
08-FW-A-SSEJP-02	8E-08	0.0009	None identified	None identified
08-FW-A-SS16-0-2B	7E-08	0.001	None identified	None identified
08FWADB04SS0-02	7E-08	0.000001	None identified	None identified
08FWADB04SS0-03	7E-08	0.000001	None identified	None identified
07FW-A-EXTSA-12	7E-08	0.004	None identified	None identified
08-FW-A-SSWJP-02	7E-08	0.0007	None identified	None identified
08FWADB04SS0-04	7E-08	0.0000007	None identified	None identified
07FW-A-EXTSA-26	6E-08	0.004	None identified	None identified
07FWCDSS01-03	6E-08	0.01	None identified	None identified
08-FW-A-SSWJP-01	6E-08	0.0006	None identified	None identified
08FWADB04SS0-09	5E-08	0.0000005	None identified	None identified
08FWADB06SS-01	5E-08	0.0000007	None identified	None identified
08FWADB06SS-02	4E-08	0.0000009	None identified	None identified
08-FW-D-EXAREAD-28-0_2B	4E-08	0.05	None identified	None identified
08-FW-A-SS15-0-2	4E-08	0.0002	None identified	None identified
08-FW-E-EXE05 W101	3E-08	0.002	None identified	None identified
08-FW-A-SS33-0-2B	2E-08	0.01	None identified	None identified
08-FW-D-EXAREAD-12-0_2B	2E-08	0.1	None identified	None identified
06DP02S02	2E-08	0.2	None identified	None identified
08 FCS RISO BLD11 C2-1	2E-08	0.0002	None identified	None identified
08FWADB06SS-04	8E-09	0.0000007	None identified	None identified
08-FW-E-SS77-0-2B	7E-09	0.0007	None identified	None identified
08FWADB06SS-06	5E-09	0.0000002	None identified	None identified
08FWADB06SS-05	4E-09	0.0000002	None identified	None identified
08-FW-A-MW77-0_2B	7E-10	0.07	None identified	None identified
08-FW-C-SSSP06-02B	5E-10	0.0005	None identified	None identified
08-FW-A-EXBLD31-04-2B	2E-10	0.2	None identified	None identified
06TP22S02	ND	0.003	None identified	None identified
06DP01S06	ND	0.003	None identified	None identified
08 FCS RISO BLD11 C5-2B	ND	0.000006	None identified	None identified
06DP01S04	ND	0.000002	None identified	None identified
08FWADB06SS-10	ND	0.0000005	None identified	None identified
08FWADB04SS0-10	ND	0.0000002	None identified	None identified
08FWADB06SS-08	ND	0.00000001	None identified	None identified
06DP01S05	ND	ND	None identified	None identified
06SB57S02	ND	ND	None identified	None identified
06SB80S02	ND	ND	None identified	None identified
07FW-A-EXTSA-09	ND	ND	None identified	None identified
07FW-A-EXTSA-10	ND	ND	None identified	None identified
07FW-A-EXTSA-11	ND	ND	None identified	None identified
07FW-A-EXTSA-13	ND	ND	None identified	None identified
07FW-A-EXTSA-14	ND	ND	None identified	None identified
07FW-A-EXTSA-15	ND	ND	None identified	None identified
07FW-A-EXTSA-16	ND	ND	None identified	None identified
07FW-E-EX52-W701A	ND	ND	None identified	None identified
07FW-E-EX52-W702A	ND	ND	None identified	None identified
07FW-E-EX52-W703A	ND	ND	None identified	None identified

TABLE 7-6
Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)
Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-W704A	ND	ND	None identified	None identified
07FW-E-EX52-W705A	ND	ND	None identified	None identified
07FW-E-EX52-W706A	ND	ND	None identified	None identified
07FW-E-EX52-W707A	ND	ND	None identified	None identified
07FW-E-EX52-W708A	ND	ND	None identified	None identified
07FW-E-EXSB98-F603	ND	ND	None identified	None identified
07FW-E-EXSB98-F604	ND	ND	None identified	None identified
08FWAMW78-1_2	ND	ND	None identified	None identified
08FWAMW79-1_2	ND	ND	None identified	None identified
08FWAMW80-1_2B	ND	ND	None identified	None identified
08-FW-A-SSWJP-02B	ND	ND	None identified	None identified
08-FW-E-EXE05 W102	ND	ND	None identified	None identified
08-FW-E-EXE05 W103	ND	ND	None identified	None identified
08-FW-E-EXE05 W104	ND	ND	None identified	None identified
08-FW-E-EXN02 W03	ND	ND	None identified	None identified
09-FW-A-SS80-0-2B	ND	ND	None identified	None identified
09FWADB06SS-05	ND	ND	None identified	None identified
09-FW-A-EXBLD11-13-1	ND	ND	None identified	None identified
09-FW-A-SS82-0-2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-19-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-10-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-04-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-01-1	ND	ND	None identified	None identified
08-FW-E-SS79-0-2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-14-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-16-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-03-1	ND	ND	None identified	None identified
09-FW-E-SS85-0-2	ND	ND	None identified	None identified
08-FW-W-SS41-0_2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-13-2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-05-2	ND	ND	None identified	None identified
09-FW-A-EXBLD11-01-1	ND	ND	None identified	None identified
09-FW-D-SS87-0-2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-12-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-24-2	ND	ND	None identified	None identified
09-FW-A-EXBLD11-04-1	ND	ND	None identified	None identified
09-FW-E-SS86-0-2	ND	ND	None identified	None identified
08-FW-W-SS40-0_2	ND	ND	None identified	None identified
08-FW-W-SS39-0_2	ND	ND	None identified	None identified
09-FW-A-EXBLD11-18-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-08-1	ND	ND	None identified	None identified
08-FW-W-SS44-0_2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-02-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-05-1	ND	ND	None identified	None identified
09-FW-W-SS83-0-2	ND	ND	None identified	None identified
09-FW-A-EXBLD11-06-1	ND	ND	None identified	None identified
09-FW-A-EXBLD15-15-1	ND	ND	None identified	None identified
09FWADB04SS-04	ND	ND	None identified	None identified
08-FW-W-SS43-0_2	ND	ND	None identified	None identified
09-FW-A-EXBLD11-09-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-07-1	ND	ND	None identified	None identified
08-FW-W-SS38-0_2	ND	ND	None identified	None identified
09-FW-A-EXBLD15-11-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-12-1	ND	ND	None identified	None identified
09-FW-A-EXBLD11-17-1	ND	ND	None identified	None identified
09-FW-B-SS81-0-2	ND	ND	None identified	None identified
09-FW-A-SS84-0-2	ND	ND	None identified	None identified
08-FW-W-SS43-0_2B	ND	ND	None identified	None identified
07FW-SPN-02	ND	ND	None identified	None identified
09FWADB04SS-06	ND	ND	None identified	None identified

TABLE 7-6

Summary of Risk and Hazard Estimates for Surface Soil (0-2 ft bgs)

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
09FWADB04SS-07	ND	ND	None identified	None identified
09FWADB04SS-02	ND	ND	None identified	None identified
09-FW-A-EXBLD11-18-1B	ND	ND	None identified	None identified
07FW-SPSE-02	ND	ND	None identified	None identified
09FWADB04SS-03	ND	ND	None identified	None identified
09FWADB06SS-02	ND	ND	None identified	None identified
07FW-SPSW-01	ND	ND	None identified	None identified
09FWADB04SS-09	ND	ND	None identified	None identified
09FWADB06SS-03	ND	ND	None identified	None identified
09FWADB04SS-05	ND	ND	None identified	None identified
09FWADB06SS-06	ND	ND	None identified	None identified
09FWADB06SS-04	ND	ND	None identified	None identified
09FWADB06SS-07	ND	ND	None identified	None identified
09FWADB06SS-08	ND	ND	None identified	None identified
07FW-SPN-01	ND	ND	None identified	None identified
09-FW-A-EXBLD15-01-1B	ND	ND	None identified	None identified
07FW-SPSE-01	ND	ND	None identified	None identified
09-FW-A-SS80-0-2	ND	ND	None identified	None identified
09FWADB04SS-10	ND	ND	None identified	None identified
07FW-SPSW-02	ND	ND	None identified	None identified
07FW-CONF-SP12-01	ND	ND	None identified	None identified
07FW-CONF-SP12-02	ND	ND	None identified	None identified
07FW-CONF-SP12-03	ND	ND	None identified	None identified
07FW-CONF-SP12-04	ND	ND	None identified	None identified
07FW-CONF-SP12-05	ND	ND	None identified	None identified
08-FCS-BLD-045 EW02	ND	ND	None identified	None identified
08-FCS-BLD-045 F05	ND	ND	None identified	None identified
08-FCS-BLD-045 NW01	ND	ND	None identified	None identified
08-FCS-BLD-045 SW03	ND	ND	None identified	None identified
08-FCS-BLD-045 WW04	ND	ND	None identified	None identified
08-FCS-BLD-09 EW03	ND	ND	None identified	None identified
08-FCS-BLD-09 F05	ND	ND	None identified	None identified
08-FCS-BLD-09 F05B	ND	ND	None identified	None identified
08-FCS-BLD-09 NW01	ND	ND	None identified	None identified
08-FCS-BLD-09 SW02	ND	ND	None identified	None identified
08-FCS-BLD-09 WW04	ND	ND	None identified	None identified
09FWADB04SS-01	ND	ND	None identified	None identified
09FWADB04SS-08B	ND	ND	None identified	None identified
09FWADB06SS-01	ND	ND	None identified	None identified
09FWADB06SS-06B	ND	ND	None identified	None identified
09FWADB06SS-09	ND	ND	None identified	None identified
09FWADB06SS-10	ND	ND	None identified	None identified
09-FW-E-EXBLD53-03-2	ND	ND	None identified	None identified
09-FW-E-EXBLD53-05-2	ND	ND	None identified	None identified
09-FW-E-EXBLD53-06-2	ND	ND	None identified	None identified
09-FW-E-EXBLD53-07-2	ND	ND	None identified	None identified
09-FW-E-EXBLD53-10-2	ND	ND	None identified	None identified

Minimum	2E-10	0.00000001
Maximum	8E-06	0.5
Average	9E-07	0.2

a. Values presented on this table are sorted by decreasing excess lifetime cancer risk. Sorting was not conducted for noncancer risks since all hazard index values were well below 1.

b. Primary contributors to the total risk are listed when ELCR > 10^{-5} or HI > 1.0.

ND = No carcinogenic or noncarcinogenic constituents detected

TABLE 7-7

Summary of Risk and Hazard Estimates for Subslab Soil Gas: Residential Indoor Inhalation

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Subslab Soil Gas Sample Location	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE [a]	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index
SG012-L	6E-06	8E-07	0.004
SG016-L	5E-06	6E-07	0.003
SG020-L	5E-06	9E-07	0.003
SG047-L	4E-06	4E-06	0.005
SG042-L	4E-06	4E-06	0.005
SG008-R	4E-06	7E-07	0.002
SG029-L	3E-06	5E-07	0.002
SG022-L	3E-06	4E-07	0.002
SG032-R	3E-06	4E-07	0.002
SG036-L	3E-06	4E-07	0.002
SG048-L	2E-06	4E-07	0.007
SG046-R	2E-06	4E-07	0.001
SG062-R	1E-06	4E-07	0.001
SG063-R	8E-07	8E-07	0.0003
SG001-L	8E-07	3E-07	0.003
SG034-R	7E-07	7E-07	0.001
SG001-R	6E-07	4E-07	0.0006
SG023-L	6E-07	2E-07	0.002
SG039-R	6E-07	6E-07	0.0003
SG062-L	6E-07	5E-07	0.0003
SG064-L	5E-07	5E-07	0.0004
SG039-L	5E-07	3E-07	0.0008
SG019-L	5E-07	4E-07	0.003
SG017-R	5E-07	2E-07	0.0005
SG034-L	5E-07	5E-07	0.05
SG061-R	5E-07	3E-07	0.0003
SG038-R	4E-07	4E-07	0.005
SG064-R	4E-07	4E-07	0.0006
SG060-R	4E-07	4E-07	0.001
SG060-L	4E-07	4E-07	0.0003
SG024-L	4E-07	4E-07	0.003
SG044-L	4E-07	3E-07	0.0003
SG031-R	4E-07	4E-07	0.0007
SG041-L	4E-07	4E-07	0.0001
SG036-R	4E-07	4E-07	0.0006
SG026-R	4E-07	4E-07	0.0004
SG061-L	4E-07	4E-07	0.0002
SG041-R	4E-07	3E-07	0.0003
SG027-R	3E-07	3E-07	0.0005
SG027-L	3E-07	3E-07	0.0004

TABLE 7-7

Summary of Risk and Hazard Estimates for Subslab Soil Gas: Residential Indoor Inhalation

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Subslab Soil Gas Sample Location	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE [a]	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index
SG037-L	3E-07	3E-07	0.0004
SG007-L	3E-07	3E-07	0.007
SG024-R	3E-07	3E-07	0.0005
SG045-L	3E-07	3E-07	0.0003
SG035-R	3E-07	3E-07	0.0005
SG003-R	3E-07	3E-07	0.01
SG033-R	3E-07	3E-07	0.02
SG037-R	3E-07	3E-07	0.0001
SG065-L	3E-07	9E-08	0.0005
SG011-R	3E-07	3E-07	0.0006
SG032-L	3E-07	3E-07	0.0003
SG017-L	3E-07	3E-07	0.002
SG030-L	3E-07	3E-07	0.0004
SG021-R	3E-07	3E-07	0.0001
SG030-R	3E-07	3E-07	0.0005
SG063-L	3E-07	3E-07	0.0001
SG020-R	3E-07	3E-07	0.0002
SG046-L	3E-07	3E-07	0.0003
SG043-L	3E-07	3E-07	0.0003
SG009-L	3E-07	2E-07	0.0003
SG021-L	3E-07	2E-07	0.0002
SG022-R	3E-07	2E-07	0.0001
SG026-L	3E-07	2E-07	0.0003
SG045-R	3E-07	3E-07	0.0009
SG048-R	2E-07	2E-07	0.0003
SG042-R	2E-07	2E-07	0.0001
SG033-L	2E-07	2E-07	0.0003
SG044-R	2E-07	2E-07	0.0001
SG047-R	2E-07	2E-07	0.0002
SG065-R	2E-07	2E-07	0.0001
SG038-L	2E-07	2E-07	0.0004
SG013-L	2E-07	2E-07	0.006
SG025-R	2E-07	2E-07	0.0003
SG009-R	2E-07	2E-07	0.0004
SG004-L	1E-07	1E-07	0.0004
SG018-R	1E-07	1E-07	0.0003
SG015-R	1E-07	1E-07	0.0006
SG031-L	1E-07	9E-08	0.002
SG002-L	1E-07	6E-08	0.0001
SG049-R	1E-07	1E-07	0.0003

TABLE 7-7

Summary of Risk and Hazard Estimates for Subslab Soil Gas: Residential Indoor Inhalation

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Subslab Soil Gas Sample Location	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE [a]	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index
SG012-R	1E-07	1E-07	0.0002
SG018-L	1E-07	8E-08	0.0001
SG014-R	1E-07	8E-08	0.0003
SG015-L	1E-07	9E-08	0.0004
SG011-L	1E-07	1E-07	0.0001
SG019-R	9E-08	9E-08	0.0003
SG028-L	8E-08	7E-08	0.0001
SG049-L	8E-08	7E-08	0.0007
SG010-L	8E-08	8E-08	0.0001
SG043-R	7E-08	7E-08	0.00009
SG016-R	7E-08	7E-08	0.0003
SG006-L	7E-08	6E-08	0.0002
SG040-R	7E-08	5E-08	0.0004
SG005-L	6E-08	6E-08	0.0001
SG006-R	6E-08	6E-08	0.00007
SG003-L	5E-08	5E-08	0.0003
SG028-R	5E-08	5E-08	0.0003
SG029-R	5E-08	5E-08	0.0003
SG008-L	5E-08	5E-08	0.0001
SG010-R	5E-08	3E-08	0.002
SG004-R	5E-08	5E-08	0.0001
SG035-L	4E-08	4E-08	0.0003
SG005-R	4E-08	4E-08	0.0003
SG014-L	4E-08	3E-08	0.0001
SG025-L	4E-08	3E-08	0.0004
SG023-R	3E-08	3E-08	0.00005
SG002-R	2E-08	2E-08	0.00004
SG007-R	2E-08	2E-08	0.00006
SG013-R	2E-08	2E-08	0.0001
SG040-L	2E-08	2E-08	0.0005
Minimum for 110 Units	2E-08	2E-08	0.00004
Maximum for 110 Units	6E-06	4E-06	0.05
Average for 110 Units	6E-07	3E-07	0.002

a. Values presented on this table are sorted by decreasing excess lifetime cancer risk. Sorting was not conducted for noncancer risks since all hazard index values were well below 1.

TCE = Trichloroethene

TABLE 7-8
Summary of Risk and Hazard Estimates for Ambient Background Air: Residential Inhalation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Sample Date	Excess Lifetime Cancer Risk	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
07FW-OFFSITE-AMBIENT	30-Aug-07	1E-06	0.07	None identified	None identified
07FW-OffSite-Ambient-02	24-Sep-07	1E-06	0.006	None identified	None identified
07FW-OffSite-Ambient-03	20-Oct-07	ND	0.002	None identified	None identified
08FWAAA-Fence	01-Oct-08	1E-05	0.4	None identified	None identified
08FWOAW1-3	04-Dec-08	5E-05	1	Naphthalene 57% Benzene 23% Carbon tetrachloride 7% Tetrachloroethene 4%	None identified
08FWOAE1-3	04-Dec-08	2E-05	0.5	Benzene 31% Naphthalene 27% Carbon tetrachloride 15% 1,1,2,2-Tetrachloroethane 9%	None identified
08FWOAW2-3	05-Dec-08	3E-05	0.4	Benzene 43% Tetrachloroethene 14% Naphthalene 13% Carbon tetrachloride 11% Trichloroethene 7%	None identified
08FWOAE2-3	05-Dec-08	3E-05	0.5	Benzene 34% Naphthalene 23% Carbon tetrachloride 11% Trichloroethene 10% Tetrachloroethene 10%	None identified
08FWOAE3-3	06-Dec-08	1E-05	0.2	None identified	None identified
08FWOAW3-3	06-Dec-08	7E-06	0.1	None identified	None identified
09FWOAW1-2	30-Aug-09	7E-06	0.02	None identified	None identified
09FWOAE1-2	30-Aug-09	2E-05	0.03	Trichloroethene 44% Tetrachloroethene 24% Carbon tetrachloride 16% Chloroform 12%	None identified

Notes:
a. Primary contributors to the total risk are listed when ELCR > 10^{-5} or HI > 1.0.
ND = No carcinogenic constituents detected

TABLE 7-9

Summary of Risk and Hazard Estimates for Domestic Use of Groundwater

Reasonably Anticipated Future Land Use (Residential Exposure) Scenario: Capture Zone Wells Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Well ID	Excess Lifetime Cancer Risk	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
Wells Within Capture Zone Defined by Hypothetical Pumping of 1,000 Gallons per Minute				
MW78	1E-06	0.02	None identified	None identified
Bldg 3559 [b]	5E-07	0.005	None identified	None identified
MW85	ND	0.005	None identified	None identified
MW86	ND	0.002	None identified	None identified
MW90	ND	0.005	None identified	None identified
MW87	ND	ND	None identified	None identified
MW88	ND	ND	None identified	None identified
MW89	ND	ND	None identified	None identified
Additional Wells Within Capture Zone Defined by Hypothetical Pumping of 1,700 Gallons per Minute				
MW79	2E-03	2	1,2,3-Trichloropropane 100%	1,2,3-Trichloropropane 83%
MW47	9E-04	1	1,2,3-Trichloropropane 99% Vinyl Chloride 0.3% bis(2-Ethylhexyl)phthalate 0.2%	1,2,3-Trichloropropane 87%
MW08	4E-04	1	1,2,3-Trichloropropane 89% Dibenzo(a,h)anthracene 5% Benzo(a)pyrene 4% Indeno(1,2,3-cd)pyrene 0.7% Benzo(b)fluoranthene 0.6% bis(2-Ethylhexyl)phthalate 0.5% Benzo(a)anthracene 0.4%	Cobalt 55% 1,2,3-Trichloropropane 34%
MW39	5E-05	0.9	1,2,3-Trichloropropane 49% Naphthalene 46%	None identified

Notes:

a. Primary contributors to the total risk are listed when ELCR > 10^{-5} or HI > 1.0.

b. Groundwater risk and hazard estimates are from the Post supply well at Building 3559 sampled prior to treatment. Although there is no indication of contaminant migration from the FCS toward the water supply well, the results for that well are conservatively included since they represent current and reasonably anticipated future water use conditions.

ND = No carcinogenic or noncarcinogenic constituents detected

TABLE 7-10

Summary of Multi-Media Risk and Hazard Estimates for the Reasonably Anticipated Future Land Use (Residential Exposure) Scenario

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Exposure Scenario and Medium	Exposure Route	Excess Lifetime Cancer Risk	Noncancer Hazard Index
Future Resident (Maximum Location) - Direct Contact with Soil (0-2 ft bgs)	Ingestion	5x10-6	0.5
	Dermal	2x10-6	0.0004
	Inhalation	1x10-7	0.01
	Total	8x10-6 [a]	0.5 [a]
Future Resident (Maximum Location) - Vapor Intrusion to Indoor Air	Inhalation	6x10-6 [b]	0.05 [b]
Future Resident - Domestic Use of Post Supply Water	Ingestion	--	0.001
	Dermal	--	0.00001
	Inhalation	5x10-7	0.003
	Total	5x10-7 [c]	0.005 [c]
Cumulative Multi-Media Risk and Hazard		1x10-5	0.5

Notes:

a. Surface soil direct contact values represent the maximum risk (08-FW-A-EXBLD22-23-0_5) and hazard (07FWCDSS01-01) estimates from any single sample across the entire FCS.

b. Vapor intrusion values represent the maximum risk (SG012-L) and hazard (SG034-L) estimates from any single subslab location across the entire FCS.

c. Groundwater risk and hazard estimates are from the Post supply well at Building 3559 sampled prior to treatment. Although there is no indication of contaminant migration from the FCS toward the water supply well, the results for that well are conservatively included since they represent current and reasonably anticipated future water use conditions.

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-A-EXBLD24-19-4	8E-05	0.3	1,2,3-Trichloropropane 98% Vinyl Chloride 2%	None identified
07FW-A-EXBld4806R1B	3E-05	0.03	N-Nitrosodimethylamine 61% Dibenzo(a,h)anthracene 15% Benzo(a)pyrene 15%	None identified
07FW-A-EXBLD48-43	3E-05	0.3	Trichloroethene 53% Vinyl Chloride 46%	None identified
07FWAMW62-3.0	2E-05	0.02	Benzo(a)pyrene 61% Dibenzo(a,h)anthracene 16%	None identified
07FW-E-EX52-FL04	1E-05	0.8	None identified	None identified
08-FW-A-EXBLD24-16-6	8E-06	0.4	None identified	None identified
07FW-A-EXBld4801R1	8E-06	0.002	None identified	None identified
08-FW-A-EXBLD11-01-4	7E-06	0.4	None identified	None identified
09-FW-A-EXBLD49-03-11	5E-06	0.3	None identified	None identified
06TP19S02	5E-06	5	None identified	Copper 54% Aluminum 41%
08-FW-C-EXBLD01-13-1_5	5E-06	0.3	None identified	None identified
08-FW-A-EXBLD11-06-4	4E-06	0.4	None identified	None identified
09-FW-A-EXBLD49-02-09B	4E-06	0.1	None identified	None identified
07FW-A-EXBld15-03	4E-06	0.2	None identified	None identified
08-FW-A-EXBLD12-02-3	4E-06	0.3	None identified	None identified
08-FW-A-EXBLD24-15-6	4E-06	0.3	None identified	None identified
08-FW-A-EXBLD11-08-5	4E-06	0.3	None identified	None identified
07FW-A-EXBld15-14	4E-06	0.2	None identified	None identified
07FW-A-EXBld48-14R1	3E-06	0.004	None identified	None identified
08-FW-A-EXBLD15-47-10_12	3E-06	0.4	None identified	None identified
08-FW-A-EXBLD12-03-3	3E-06	0.3	None identified	None identified
09-FW-A-EXBLD15-16-4	3E-06	0.2	None identified	None identified
07FW-E-EX52-W427B	3E-06	0.2	None identified	None identified
06SI33S01	3E-06	0.000004	None identified	None identified
07FWDMW14-3_1	3E-06	0.3	None identified	None identified
07FW-A-EXBld48-51	3E-06	0.3	None identified	None identified
07FW-E-EX52-NW00	3E-06	0.2	None identified	None identified
07FW-E-EX52-W106A	3E-06	0.2	None identified	None identified
07FWAMW41-10_8	3E-06	0.2	None identified	None identified
08-FW-A-EXBLD24-08-5	3E-06	0.3	None identified	None identified
05FTW-A56-N10-24-48-SO	3E-06	0.2	None identified	None identified
09-FW-A-EXBLD11-14-3	3E-06	0.4	None identified	None identified
07FW-E-EX52-NW03	3E-06	0.2	None identified	None identified
08-FW-A-EXBLD11-02-4	3E-06	0.3	None identified	None identified
07FWBMW37-3_0	3E-06	0.2	None identified	None identified
08-FW-A-EXBLD24-13-4	3E-06	0.2	None identified	None identified
07FW-E-EX52-SW01	2E-06	0.1	None identified	None identified
08-FW-A-EXBLD11-07-8	2E-06	0.3	None identified	None identified
07FW-A-EXBld48-56	2E-06	0.3	None identified	None identified
07FW-A-EXBld48-28	2E-06	0.3	None identified	None identified
05-FTW-A52-NE12-72-96-SO	2E-06	0.1	None identified	None identified
08-FW-A-EXBLD11-03-2_5	2E-06	0.3	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-C-EXBLD01-15-3_5	2E-06	0.3	None identified	None identified
08-FW-A-EXBLD31-07-3	2E-06	0.6	None identified	None identified
07FW-E-EX52-W105A	2E-06	0.1	None identified	None identified
09-FW-E-EXBLD53-01-3	2E-06	0.4	None identified	None identified
08-FW-A-EXBLD24-18-8B	2E-06	0.3	None identified	None identified
07FW-E-EX52-F444A	2E-06	0.1	None identified	None identified
08-FW-A-EXBLD31-06-4	2E-06	0.6	None identified	None identified
07FW-A-EXBld48-16R1	2E-06	0.009	None identified	None identified
08-FW-A-EXBLD12-06-3	2E-06	0.4	None identified	None identified
07FWAMW52-3_0	2E-06	0.3	None identified	None identified
04FHFW25SL	2E-06	0.06	None identified	None identified
08-FW-D-EXAREAD-20-4_6	2E-06	0.4	None identified	None identified
07FW-A-EXBld48-29	2E-06	0.5	None identified	None identified
07FW-A-EXBld48-57	2E-06	0.2	None identified	None identified
08-FW-A-EXBLD24-09-5	2E-06	0.3	None identified	None identified
08-FW-A-EXBLD12-01-3	2E-06	0.3	None identified	None identified
06TP20S02	2E-06	0.05	None identified	None identified
07FW-A-EXBld48-27	2E-06	0.4	None identified	None identified
08-FW-A-EXBLD24-07-5	2E-06	0.3	None identified	None identified
09-FW-A-EXBLD15-31-11	2E-06	0.3	None identified	None identified
04FHFW17SL	2E-06	0.04	None identified	None identified
08-FW-D-EXAREAD-23-3_5	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-19-3_5	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-18-3_5	2E-06	0.5	None identified	None identified
08-FW-A-EXBLD22-38-6	2E-06	0.3	None identified	None identified
08-FW-D-EXAREAD-16-2_4	2E-06	0.2	None identified	None identified
08-FW-A-EXBLD11-05-2_5B	2E-06	0.2	None identified	None identified
08-FW-D-EXAREAD-15-3_5	2E-06	0.5	None identified	None identified
08-FW-D-EXAREAD-26-2_4	2E-06	0.5	None identified	None identified
08-FW-D-EXAREAD-11-2_4	2E-06	0.4	None identified	None identified
08-FW-A-EXBLD16-03-1_5	2E-06	0.4	None identified	None identified
05FTW-TSW64-4-SO	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-27-2_4	2E-06	0.3	None identified	None identified
04FHFW59SO	2E-06	0.09	None identified	None identified
07FW-E-EX52-F442B	2E-06	0.1	None identified	None identified
08-FW-D-EXAREAD-03-2_4	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-14-2_4	2E-06	0.3	None identified	None identified
07FW-E-EX52-F202A	2E-06	0.1	None identified	None identified
07FW-E-EX52-W329A	2E-06	0.1	None identified	None identified
07FWBMW26-8_5	2E-06	0.1	None identified	None identified
06TP24S01	2E-06	0.3	None identified	None identified
07FW-A-EXBld48-15R1	2E-06	0.003	None identified	None identified
07FW-E-EX52-W325B	2E-06	0.09	None identified	None identified
08-FW-A-EXBLD11-04-2_5	2E-06	0.3	None identified	None identified
09-FW-A-EXBLD11-11-5	2E-06	0.3	None identified	None identified
07FW-A-EXBld48-38	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-08-2_4	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-29-2_4	2E-06	0.5	None identified	None identified
08-FW-D-EXAREAD-21-4_6B	2E-06	0.4	None identified	None identified
08-FW-A-EXBLD15-49-8_10	2E-06	0.3	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
09-FW-E-EXBLD55-01-5	2E-06	0.3	None identified	None identified
07FWBMW27-2_5FD	2E-06	0.002	None identified	None identified
07FWBMW67-3_5B	2E-06	0.002	None identified	None identified
07FWEMW21-3_3	2E-06	0.4	None identified	None identified
07FW-E-EX52-FL13FD	2E-06	0.09	None identified	None identified
09-FW-E-EXBLD54-02-3B	2E-06	0.3	None identified	None identified
07FW-A-EXBld15-09	2E-06	0.3	None identified	None identified
08-FW-D-EXAREAD-04-2_4	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-30-2_4	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-22-2_4	2E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-09-2_4	2E-06	0.4	None identified	None identified
07FW-E-EX52-W407A	2E-06	0.09	None identified	None identified
08-FW-C-EXBLD01-11-1_5	2E-06	0.3	None identified	None identified
07FW-E-EX52-F331A	1E-06	0.09	None identified	None identified
07FW-E-EX52-W424B	1E-06	0.09	None identified	None identified
08-FW-A-EXBLD22-32-8	1E-06	0.4	None identified	None identified
07FWEMW20-8_4	1E-06	0.2	None identified	None identified
07FWBMW36-3_5	1E-06	0.4	None identified	None identified
08-FW-A-EXBLD12-05-3	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-08	1E-06	0.3	None identified	None identified
07FWBMW32-2_5	1E-06	0.4	None identified	None identified
07FW-A-EXBld48-35	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD24-01-4	1E-06	0.3	None identified	None identified
07FW-E-EX52-FL08	1E-06	0.08	None identified	None identified
08-FW-A-EXBLD22-11-3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-31-1_3	1E-06	0.3	None identified	None identified
08-FW-A-MW78-7_5_9_5	1E-06	0.4	None identified	None identified
08-FW-A-EXBLD16-02-1_5B	1E-06	0.4	None identified	None identified
07FWBMW35-8_2	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-34-2_4	1E-06	0.3	None identified	None identified
09-FW-A-EXBLD15-22-4	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD12-04-3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD12-08-5B	1E-06	0.4	None identified	None identified
08-FW-C-EXBLD01-14-1_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD31-08-3	1E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-24-3_5	1E-06	0.4	None identified	None identified
07FW-A-EXBld48-30	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-17-1_3	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-37	1E-06	0.3	None identified	None identified
06SI09S02	1E-06	0.2	None identified	None identified
08-FW-E-EX52-W428E	1E-06	0.08	None identified	None identified
07FW-A-EXBld17-04	1E-06	0.2	None identified	None identified
09-FW-A-EXBLD11-02-3	1E-06	0.3	None identified	None identified
07FWBMW65-11_0	1E-06	0.3	None identified	None identified
09-FW-E-EXBLD51-01-4	1E-06	0.4	None identified	None identified
08-FW-A-EXBLD12-07-5	1E-06	0.4	None identified	None identified
09-FW-A-EXBLD11-10-5	1E-06	0.3	None identified	None identified
07FW-E-EX52-F333A	1E-06	0.08	None identified	None identified
06SI46S01	1E-06	0.3	None identified	None identified
07FWBMW28-3_5	1E-06	0.3	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-C-EXBLD01-08-3_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-33-4_6	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-29-4	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-50-8_10	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD31-01-3	1E-06	0.6	None identified	None identified
07FW-E-EX52-W112A	1E-06	0.08	None identified	None identified
08-FW-A-EXBLD31-05-6	1E-06	0.4	None identified	None identified
06SI36S01	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-33	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-53-10_12	1E-06	0.4	None identified	None identified
09-FW-E-EXBLD58-01-4	1E-06	0.4	None identified	None identified
07FWEMW19-3_5	1E-06	0.3	None identified	None identified
06SI47S01	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-55	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-39-2_4	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-28-7_9	1E-06	0.3	None identified	None identified
04FHFW06SL	1E-06	0.03	None identified	None identified
08-FW-C-EXBLD01-12-1_5	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-50B	1E-06	0.3	None identified	None identified
07FWCMW30-3_5	1E-06	0.3	None identified	None identified
06TP23S01	1E-06	0.3	None identified	None identified
06SI12S01	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-21-1_3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD26-09-3	1E-06	0.4	None identified	None identified
07FWAMW59-3_0	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD22-02-3	1E-06	0.3	None identified	None identified
07FW-E-EX52-F337A	1E-06	0.07	None identified	None identified
07FW-E-EX52-W802B	1E-06	0.07	None identified	None identified
07FW-C-EXDrum04	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-30-3_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-54-6_8	1E-06	0.4	None identified	None identified
08-FW-D-EXAREAD-10-2_4	1E-06	0.3	None identified	None identified
03FHFW22SL	1E-06	0.03	None identified	None identified
09-FW-A-EXBLD15-07-4	1E-06	0.4	None identified	None identified
08-FW-A-EXBLD15-52-6_8	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-44-8_10	1E-06	0.3	None identified	None identified
07FWAMW59-6_0	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD24-06-4	1E-06	0.2	None identified	None identified
07FWEMW17-3_5	1E-06	0.3	None identified	None identified
07FWBMW29-2_5	1E-06	0.3	None identified	None identified
09-FW-A-EXBLD11-03-3	1E-06	0.3	None identified	None identified
07FWBMW63-8_5	1E-06	0.3	None identified	None identified
05FTW-MW-2-1-SO	1E-06	0.3	None identified	None identified
07FW-C-EXDrum07-01	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD24-03-3	1E-06	0.2	None identified	None identified
09-FW-A-EXBLD15-38-11	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-13	1E-06	0.3	None identified	None identified
09-FW-A-EXBLD11-15-3	1E-06	0.4	None identified	None identified
09-FW-A-EXBLD15-39-11	1E-06	0.3	None identified	None identified
07FW-A-EXBLD48-46	1E-06	0.3	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FWEMW76-3_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-29-5_7	1E-06	0.3	None identified	None identified
07FWEMW20-2_5	1E-06	0.2	None identified	None identified
07FW-E-EX52-F110A	1E-06	0.07	None identified	None identified
08FW-E-EX52-W403C	1E-06	0.07	None identified	None identified
07FWEMW74-3_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-46-10_12	1E-06	ND	None identified	None identified
08-FW-C-EXBLD01-07-3_5	1E-06	0.3	None identified	None identified
06SI02S01	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-21	1E-06	0.4	None identified	None identified
09-FW-E-EXBLD57-01-5	1E-06	0.4	None identified	None identified
09-FW-E-EXBLD50-01-5	1E-06	0.4	None identified	None identified
08-FW-A-EXBLD24-11-4	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-05-3	1E-06	0.3	None identified	None identified
07FWEMW15-3_5	1E-06	0.1	None identified	None identified
07FW-E-EX52-W315A	1E-06	0.07	None identified	None identified
08-FW-A-EXBLD15-56-8_10	1E-06	0.3	None identified	None identified
07FWCMW31-2_5	1E-06	0.2	None identified	None identified
07FW-A-EXBld48-31	1E-06	0.3	None identified	None identified
07FWAMW52-6_0	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-36-3_5	1E-06	0.3	None identified	None identified
07FWBMW35-2_7	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-03-4	1E-06	0.3	None identified	None identified
07FW-A-EXBld15-04	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-16-1_3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-27-5_7	1E-06	0.3	None identified	None identified
07FW-A-EXBLD4802	1E-06	0.3	None identified	None identified
06SI20S02	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-51-6_8	1E-06	0.3	None identified	None identified
08-FW-A-MW77-5_6_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD16-01-1_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-57-10_12	1E-06	0.3	None identified	None identified
07FWAMW61-10_5	1E-06	0.2	None identified	None identified
06TP12S02	1E-06	0.3	None identified	None identified
07FWDMW14-7_8	1E-06	0.1	None identified	None identified
07FWDMW13-3_5FD	1E-06	0.3	None identified	None identified
04FHFW27SL	1E-06	0.02	None identified	None identified
07FW-A-EXBLD48-45	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-26	1E-06	0.3	None identified	None identified
09-FW-E-EXBLD56-01-3	1E-06	0.4	None identified	None identified
09-FW-A-EXBLD15-06-3	1E-06	0.4	None identified	None identified
07FWAMW40-6_0	1E-06	0.3	None identified	None identified
04FHFW35SL	1E-06	0.02	None identified	None identified
07FW-A-EXBld48-54	1E-06	0.3	None identified	None identified
06SI16S01	1E-06	0.2	None identified	None identified
04FHFW45SL	1E-06	0.02	None identified	None identified
07FWAMW57-3_0	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-58	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-30-4	1E-06	0.4	None identified	None identified
07FW-E-EX52-F412A	1E-06	0.06	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
05FTW-MW-2-2-SO	1E-06	0.3	None identified	None identified
09-FW-A-EXBLD15-37-10	1E-06	0.3	None identified	None identified
08-FW-A-MW77-12_5_14	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-28-7_9B	1E-06	0.004	None identified	None identified
07FW-C-EXDrum09	1E-06	0.3	None identified	None identified
04FHFW24SL	1E-06	0.02	None identified	None identified
06SI14S01	1E-06	0.3	None identified	None identified
03FHFW16SL	1E-06	0.02	None identified	None identified
07FW-A-EXBld48-53	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-45-8_10	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-41	1E-06	0.3	None identified	None identified
08-FW-A-MW79-10_14	1E-06	0.2	None identified	None identified
06SI19S01	1E-06	0.2	None identified	None identified
07FW-A-EXBld48-15	1E-06	0.3	None identified	None identified
07FWBMW67-3_5	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-59	1E-06	0.2	None identified	None identified
07FW-A-EXBld15-12	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-24-2_4	1E-06	0.3	None identified	None identified
04FHFW09SL	1E-06	0.02	None identified	None identified
07FWEMW16-8_5	1E-06	0.3	None identified	None identified
07FW-A-EXBLD48-39	1E-06	0.3	None identified	None identified
06SI17S02	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-42-10_12	1E-06	0.3	None identified	None identified
07FWAMW45-3_0	1E-06	0.3	None identified	None identified
03FHFW28SL	1E-06	0.02	None identified	None identified
09-FW-A-EXBLD15-09-7	1E-06	0.3	None identified	None identified
09-FW-E-EXBLD59-02-4	1E-06	0.4	None identified	None identified
07FW-C-EXDrum05	1E-06	0.3	None identified	None identified
07FWBMW26-3_2	1E-06	0.3	None identified	None identified
05FTW-MW-1-1-SO	1E-06	0.2	None identified	None identified
07FWAMW44-6_5	1E-06	0.3	None identified	None identified
07FW-A-EXBld17-03	1E-06	0.3	None identified	None identified
09-FW-A-EXBLD15-08-4	1E-06	0.3	None identified	None identified
07FW-A-EXBld15-01B	1E-06	0.1	None identified	None identified
08-FW-A-EXBLD15-26-2_4	1E-06	0.3	None identified	None identified
06SI19S02	1E-06	0.3	None identified	None identified
06SI13S02	1E-06	0.3	None identified	None identified
06SI17S01	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD22-14-3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-15-3	1E-06	0.3	None identified	None identified
04FHFW77SO	1E-06	0.06	None identified	None identified
07FWEMW74-7_5	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD26-08-3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD22-13-3B	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD26-07-3	1E-06	0.2	None identified	None identified
07FWBMW67-8_5	1E-06	0.2	None identified	None identified
07FWBMW25-3_5	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-11R1	1E-06	0.006	None identified	None identified
04FHFW30SL	1E-06	0.02	None identified	None identified
07FWEMW74-10_0	1E-06	0.2	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
06TP23S03	1E-06	0.2	None identified	None identified
07FWEMW21-8_5	1E-06	0.3	None identified	None identified
07FW-A-EXBld48-24	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-18-1_3	1E-06	0.3	None identified	None identified
06SI03S01	1E-06	0.2	None identified	None identified
07FW-A-EXBld15-07	1E-06	0.2	None identified	None identified
06TP07S01	1E-06	0.3	None identified	None identified
07FWAMW54-3_5	1E-06	0.3	None identified	None identified
06SI01S01	1E-06	0.2	None identified	None identified
03FHFW01SL	1E-06	0.02	None identified	None identified
07FWEMW21-10_5	1E-06	0.3	None identified	None identified
07FW-A-EXBLD48-48	1E-06	0.3	None identified	None identified
07FWAMW39-3_0	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-40-0_3	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-23-1_3	1E-06	0.3	None identified	None identified
07FWAMW40-3_0	1E-06	0.3	None identified	None identified
06TP08S01	1E-06	0.3	None identified	None identified
08-FW-D-EXAREAD-02-2_4	1E-06	0.2	None identified	None identified
08-FW-A-EXBLD15-20-2_4	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD15-22-2_4	1E-06	0.3	None identified	None identified
07FWAMW72-3_0	1E-06	0.3	None identified	None identified
06SI13S01	1E-06	0.2	None identified	None identified
07FW-A-EXBLD4801	1E-06	0.2	None identified	None identified
07FWAMW73-3_0B	1E-06	0.1	None identified	None identified
08-FW-A-EXBLD15-59-3_4	1E-06	0.2	None identified	None identified
07FWBMW58-3_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD24-02-3	1E-06	0.3	None identified	None identified
07FWAMW55-6_0	1E-06	0.3	None identified	None identified
08-FW-A-MW79-5_6_5	1E-06	0.3	None identified	None identified
08-FW-A-EXBLD31-09-3	1E-06	0.3	None identified	None identified
07FW-C-EXDrum06-01	1E-06	0.3	None identified	None identified
07FW-A-EXBLD4804	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-16-3	9E-07	0.3	None identified	None identified
07FW-E-EX52-W416A	9E-07	0.06	None identified	None identified
07FW-A-EXBld15-15	9E-07	0.2	None identified	None identified
07FW-C-EXDrum02	9E-07	0.3	None identified	None identified
07FW-E-EX52-W210A	9E-07	0.06	None identified	None identified
07FWAMW56-6_0	9E-07	0.3	None identified	None identified
07FWAMW42-10_4	9E-07	0.1	None identified	None identified
06SI10S01	9E-07	0.2	None identified	None identified
04FHFW41SL	9E-07	0.02	None identified	None identified
07FWEMW22-3_2	9E-07	0.3	None identified	None identified
07FWAMW49-3_0	9E-07	0.3	None identified	None identified
07FWAMW47-3_0	9E-07	0.3	None identified	None identified
08-FW-A-MW78-11_13	9E-07	0.3	None identified	None identified
09-FW-A-EXBLD15-17-4	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD24-14-6	9E-07	0.2	None identified	None identified
07FWBMW63-3_5	9E-07	0.1	None identified	None identified
08-FW-A-MW80-10_11_5	9E-07	0.3	None identified	None identified
07FW-A-EXBld15-13	9E-07	0.2	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
09-FW-A-EXBLD15-36-10	9E-07	0.3	None identified	None identified
04FHFW44SL	9E-07	0.02	None identified	None identified
07FW-A-EXBld15-08	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-01-3	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-31-3	9E-07	0.3	None identified	None identified
06TP26S02	9E-07	0.2	None identified	None identified
07FWCMW34-3_5	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD22-28-6	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD24-12-4	9E-07	0.3	None identified	None identified
06TP11S02	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD24-20-4	9E-07	0.3	None identified	None identified
07FW-A-EXBld48-25	9E-07	0.3	None identified	None identified
07FWAMW73-6_0	9E-07	0.3	None identified	None identified
07FWAMW42-3_0	9E-07	0.3	None identified	None identified
07FWAMW53-3_0	9E-07	0.3	None identified	None identified
07FWAMW41-6_0	9E-07	0.3	None identified	None identified
06SI20S01	9E-07	0.2	None identified	None identified
07FWAMW55-3_5	9E-07	0.3	None identified	None identified
06SI11S01	9E-07	0.2	None identified	None identified
07FW-A-EXBld48-19B	9E-07	0.2	None identified	None identified
09-FW-A-EXBLD49-04-07	9E-07	0.3	None identified	None identified
07FWAMW43-3_0FD	9E-07	0.2	None identified	None identified
07FWAMW55-11	9E-07	0.2	None identified	None identified
07FW-A-EXBLD48-44	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD31-03-3	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD15-43-10_12	9E-07	0.3	None identified	None identified
09-FW-A-EXBLD15-23-4	9E-07	0.3	None identified	None identified
07FWEMW16-3_2	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-36-6	9E-07	0.2	None identified	None identified
07FW-A-EXBld48-22	9E-07	0.3	None identified	None identified
06SI01S02	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD15-41-2_4	9E-07	0.2	None identified	None identified
06SI03S02	9E-07	0.2	None identified	None identified
06SI37S01	9E-07	0.2	None identified	None identified
06TP13S01	9E-07	0.2	None identified	None identified
07FW-A-EXBld15-02	9E-07	0.3	None identified	None identified
07FW-E-EX52-W406A	9E-07	0.05	None identified	None identified
06TP04S01	9E-07	0.2	None identified	None identified
07FWAMW44-3_0	9E-07	0.2	None identified	None identified
07FWAMW70-6_0	9E-07	0.3	None identified	None identified
06SI08S02	9E-07	0.02	None identified	None identified
07FW-A-EXBld15-11	9E-07	0.2	None identified	None identified
08-FW-A-EXBLD26-06-6	9E-07	0.3	None identified	None identified
06TP06S02	9E-07	0.2	None identified	None identified
06SI44S01	9E-07	0.2	None identified	None identified
06SI18S01	9E-07	0.2	None identified	None identified
07FWAMW49-6_5	9E-07	0.3	None identified	None identified
07FWAMW51-3_0	9E-07	0.3	None identified	None identified
08-FW-A-EXBLD22-04-3	9E-07	0.3	None identified	None identified
07FWAMW56-4_0	9E-07	0.3	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-C-EXDrum01	9E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-18-5	9E-07	0.3	None identified	None identified
04FHFW38SL	9E-07	0.02	None identified	None identified
07FWAMW51-10_8	8E-07	0.1	None identified	None identified
06TP12S01	8E-07	0.2	None identified	None identified
07FWAMW70-3_0B	8E-07	0.3	None identified	None identified
06TP11S01	8E-07	0.2	None identified	None identified
07FWDMW13-10_1	8E-07	0.2	None identified	None identified
08FWAMW80B-01-2_6	8E-07	0.2	None identified	None identified
06TP10S02	8E-07	0.2	None identified	None identified
04FHFW33SL	8E-07	0.02	None identified	None identified
07FW-A-EXBld15-05	8E-07	0.2	None identified	None identified
07FWAMW52-11	8E-07	0.2	None identified	None identified
08-FW-A-MW81-12-14	8E-07	0.2	None identified	None identified
07FWBMW23-3_5	8E-07	0.2	None identified	None identified
07FWEMW17-7_5	8E-07	0.2	None identified	None identified
07FWAMW41-3_0FD	8E-07	0.2	None identified	None identified
07FWBMW29-12_5	8E-07	0.2	None identified	None identified
07FWCMW34-7_5	8E-07	0.2	None identified	None identified
08-FW-A-EXBLD15-48-8_10	8E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-42	8E-07	0.3	None identified	None identified
04FHFW46SL	8E-07	0.02	None identified	None identified
07FW-A-EXBLD4803-01	8E-07	0.2	None identified	None identified
07FWAMW53-10_4	8E-07	0.2	None identified	None identified
07FWAMW43-7_0	8E-07	0.3	None identified	None identified
07FWAMW56-10_7	8E-07	0.2	None identified	None identified
07FW-E-EX52-FL06	8E-07	0.05	None identified	None identified
06TP13S02	8E-07	0.2	None identified	None identified
04FHFW22SL	8E-07	0.01	None identified	None identified
07FWBMW33-8_5	8E-07	0.2	None identified	None identified
06SI11S02	8E-07	0.2	None identified	None identified
07FW-A-EXBld48-22R1	8E-07	0.005	None identified	None identified
08-FW-A-EXBLD24-05-3	8E-07	0.2	None identified	None identified
07FWAMW46-3_0	8E-07	0.2	None identified	None identified
07FWBMW38-3_5	8E-07	0.2	None identified	None identified
07FWBMW65-7_5	8E-07	0.2	None identified	None identified
06SI14S02	8E-07	0.2	None identified	None identified
07FW-A-EXBld48-23	8E-07	0.3	None identified	None identified
07FWDMW18-3_5	8E-07	0.2	None identified	None identified
07FWAMW47-6_0	8E-07	0.2	None identified	None identified
07FWBMW67-10_0	8E-07	0.2	None identified	None identified
07FW-A-EXBld48-52	8E-07	0.2	None identified	None identified
06TP07S02	8E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-29-9	8E-07	0.3	None identified	None identified
07FWAMW60-3_0	8E-07	0.3	None identified	None identified
06SB01S01	8E-07	0.2	None identified	None identified
07FW-A-EXBld48-14	8E-07	0.3	None identified	None identified
04FHFW20SL	8E-07	0.02	None identified	None identified
06SB04S01	8E-07	0.2	None identified	None identified
07FWAMW44-10_3	8E-07	0.2	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-A-EXBld48-12R1	8E-07	0.004	None identified	None identified
07FWAMW61-6_0	8E-07	0.1	None identified	None identified
03FHFW18SL	8E-07	0.02	None identified	None identified
08-FW-A-EXBLD22-40-8	8E-07	0.2	None identified	None identified
07FWAMW42-6_0	8E-07	0.2	None identified	None identified
07FW-C-EXDrum03	7E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-26-11	7E-07	0.3	None identified	None identified
07FWAMW60-6_0	7E-07	0.2	None identified	None identified
07FWAMW40-10_5	7E-07	0.3	None identified	None identified
06TP09S01	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD15-50-10_12B	7E-07	0.2	None identified	None identified
06SI08S01	7E-07	0.2	None identified	None identified
06SI02S02	7E-07	0.2	None identified	None identified
07FWEMW20-10_6	7E-07	0.2	None identified	None identified
07FWAMW57-7_0	7E-07	0.3	None identified	None identified
07FWEMW16-12_5	7E-07	0.2	None identified	None identified
07FW-A-EXBld15-06	7E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-34-11	7E-07	0.3	None identified	None identified
07FWEMW76-8_0	7E-07	0.2	None identified	None identified
07FWEMW15-8_1	7E-07	0.2	None identified	None identified
05FTW-MW-1-2-SO	7E-07	0.2	None identified	None identified
07FWBMW64-3_5	7E-07	0.2	None identified	None identified
07FWEMW19-8_1	7E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-25-11	7E-07	0.3	None identified	None identified
07FWEMW15-10_2	7E-07	0.2	None identified	None identified
07FWAMW53-6_0	7E-07	0.3	None identified	None identified
08-FW-A-EXBLD22-34-6	7E-07	0.2	None identified	None identified
06SI16S02	7E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-35-10	7E-07	0.3	None identified	None identified
07FW-A-EXBld48-11	7E-07	0.2	None identified	None identified
06SI04S01	7E-07	0.2	None identified	None identified
07FW-A-EXBLD48-47B	7E-07	0.1	None identified	None identified
06SI07S01	7E-07	0.2	None identified	None identified
06SI10S02	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-37-7	7E-07	0.2	None identified	None identified
07FW-C-EXDrum08	7E-07	0.2	None identified	None identified
07FW-A-EXBld17-02	7E-07	0.2	None identified	None identified
07FWAMW48-10_6	7E-07	0.1	None identified	None identified
09-FW-A-EXBLD15-27-11	7E-07	0.3	None identified	None identified
07FWAMW46-7_0	7E-07	0.2	None identified	None identified
06TP21S01	7E-07	0.2	None identified	None identified
07FWAMW68-6_0	7E-07	0.2	None identified	None identified
05FTW-A54-N12-24-48-SO	7E-07	0.04	None identified	None identified
06SI18S02	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-43	7E-07	0.2	None identified	None identified
07FWAMW71-6_0	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-35-5	7E-07	0.2	None identified	None identified
06SI05S02	7E-07	0.2	None identified	None identified
06SI06S02	7E-07	0.2	None identified	None identified
07FWEMW76-10_5	7E-07	0.2	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-A-EXBLD15-58-10_12	7E-07	0.2	None identified	None identified
06TP03S02	7E-07	0.2	None identified	None identified
07FWAMW72-10_0	7E-07	0.2	None identified	None identified
07FWAMW45-10_8	7E-07	0.2	None identified	None identified
07FWAMW73-10_0	7E-07	0.2	None identified	None identified
07FWCMW31-7_5	7E-07	0.2	None identified	None identified
07FWAMW71-3_0	7E-07	0.2	None identified	None identified
09-FW-A-EXBLD15-21-5	7E-07	0.2	None identified	None identified
07FWBMW64-10_5	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-12-4	7E-07	0.3	None identified	None identified
07FW-E-EX52-W408A	7E-07	0.04	None identified	None identified
06SI12S02	7E-07	0.2	None identified	None identified
07FW-E-EX52-W110A	7E-07	0.04	None identified	None identified
07FWBMW64-8_2	7E-07	0.2	None identified	None identified
05FTW-MW-3-1 6-8-SO	7E-07	0.2	None identified	None identified
08-FW-A-EXBLD24-10-5	7E-07	0.2	None identified	None identified
07FW-A-EXBld48-10	7E-07	0.2	None identified	None identified
07FWAMW45-7_0	7E-07	0.2	None identified	None identified
07FWAMW68-10	7E-07	0.1	None identified	None identified
07FWAMW62-10_0	7E-07	0.2	None identified	None identified
07FW-A-EXBld48-19R1	7E-07	0.0005	None identified	None identified
07FW-E-EX52-F330A	6E-07	0.04	None identified	None identified
06SB03S01	6E-07	0.2	None identified	None identified
06TP09S02	6E-07	0.2	None identified	None identified
05FTW-MW-3-2 10-12-SO	6E-07	0.1	None identified	None identified
07FWBMW24-8_5	6E-07	0.2	None identified	None identified
04FHFW40SL	6E-07	0.01	None identified	None identified
07FWAMW54-10_3	6E-07	0.1	None identified	None identified
07FWBSB66-8_0	6E-07	0.2	None identified	None identified
04FHFW29SL	6E-07	0.01	None identified	None identified
07FW-A-EXBld48-12B	6E-07	0.2	None identified	None identified
07FWAMW48-6_0	6E-07	0.2	None identified	None identified
07FW-E-EX52-W101A	6E-07	0.04	None identified	None identified
09-FW-A-EXBLD15-32-11	6E-07	0.06	None identified	None identified
07FW-E-EX52-W214A	6E-07	0.04	None identified	None identified
07FWAMW69-3_0	6E-07	0.2	None identified	None identified
07FW-A-EXBld48-20	6E-07	0.1	None identified	None identified
07FW-E-EX52-W212A	6E-07	0.04	None identified	None identified
06SI13S03	6E-07	0.09	None identified	None identified
09-FW-A-EXBLD15-30-10	6E-07	0.2	None identified	None identified
04FHFW42SL	6E-07	0.01	None identified	None identified
07FWBMW27-2_5	6E-07	0.2	None identified	None identified
07FWAMW50-10_3	6E-07	0.1	None identified	None identified
09-FW-A-EXBLD15-33-11	6E-07	0.2	None identified	None identified
07FWAMW39-6_0	6E-07	0.2	None identified	None identified
07FWDMW18-8_3	6E-07	0.2	None identified	None identified
07FW-A-EXBld48-16	6E-07	0.2	None identified	None identified
07FWAMW57-10_7FD	6E-07	0.08	None identified	None identified
06SI48S01	6E-07	0.1	None identified	None identified
06SB03S02	6E-07	0.1	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FWEMW19-11	6E-07	0.2	None identified	None identified
07FWBMW29-7_5	6E-07	0.2	None identified	None identified
07FWBMW35-10_5	6E-07	0.1	None identified	None identified
07FWAMW60-10_7	6E-07	0.2	None identified	None identified
08-FW-A-EXBLD22-17-3	6E-07	0.2	None identified	None identified
07FWCMW31-12_5	6E-07	0.2	None identified	None identified
08-FW-A-EXBLD24-17-8	6E-07	0.2	None identified	None identified
07FWAMW48-3_0	6E-07	0.2	None identified	None identified
07FWBSB66-11_0	6E-07	0.2	None identified	None identified
07FWCMW30-8_2	6E-07	0.2	None identified	None identified
04FHFW03SL	6E-07	0.01	None identified	None identified
09-FW-A-EXBLD15-28-10	6E-07	0.2	None identified	None identified
07FWBMW63-11_0	6E-07	0.1	None identified	None identified
06SI09S01	6E-07	0.1	None identified	None identified
06TP24S02	6E-07	0.1	None identified	None identified
06SI14S03	6E-07	0.1	None identified	None identified
06SI15S01	6E-07	0.1	None identified	None identified
07FWBMW25-7_5	6E-07	0.2	None identified	None identified
07FW-E-EX52-F345AFD	6E-07	0.03	None identified	None identified
07FWAMW39-10_8FD	6E-07	0.1	None identified	None identified
07FWEMW22-10_6	6E-07	0.2	None identified	None identified
07FWDMW18-10_3	6E-07	0.1	None identified	None identified
06SB04S02	6E-07	0.1	None identified	None identified
07FWAMW49-10_6	5E-07	0.1	None identified	None identified
06SB01S02	5E-07	0.1	None identified	None identified
07FWBMW24-10_5	5E-07	0.1	None identified	None identified
07FW-A-EXBld15-10B	5E-07	0.02	None identified	None identified
07FWCMW30-11	5E-07	0.2	None identified	None identified
07FWBMW23-8_1	5E-07	0.2	None identified	None identified
06SI04S02	5E-07	0.1	None identified	None identified
07FWAMW72-6_0	5E-07	0.2	None identified	None identified
07FWBMW37-10_5	5E-07	0.2	None identified	None identified
07FWBMW33-3_5	5E-07	0.1	None identified	None identified
07FWBMW36-10_8	5E-07	0.1	None identified	None identified
07FWAMW46-10_8	5E-07	0.1	None identified	None identified
07FWCMW58-8_2	5E-07	0.1	None identified	None identified
07FWBMW32-12_5	5E-07	0.1	None identified	None identified
07FW-E-EX52-F502B	5E-07	0.03	None identified	None identified
07FW-E-EX52-W429A	5E-07	0.03	None identified	None identified
07FWCMW34-6_0	5E-07	0.2	None identified	None identified
07FW-A-EXBLD4805	5E-07	0.2	None identified	None identified
07FWBMW36-8_2	5E-07	0.1	None identified	None identified
08-FW-A-EXBLD26-04-3	5E-07	0.2	None identified	None identified
07FWAMW59-10_4	5E-07	0.2	None identified	None identified
07FW-A-EXBLD48-47	5E-07	0.08	None identified	None identified
07FWBMW27-8_5	5E-07	0.1	None identified	None identified
06TP06S03	5E-07	0.1	None identified	None identified
07FW-A-EXBld17-01	5E-07	0.1	None identified	None identified
07FWBMW37-7_3	5E-07	0.2	None identified	None identified
07FWEMW22-7_9	5E-07	0.2	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
06SI15S02	5E-07	0.1	None identified	None identified
07FWDMW14-10_7	5E-07	0.1	None identified	None identified
06SI37S02	5E-07	0.1	None identified	None identified
07FWEMW17-10_0	5E-07	0.1	None identified	None identified
07FWAMW50-6_0	5E-07	0.2	None identified	None identified
07FWBMW24-3_5	5E-07	0.1	None identified	None identified
06SB02S01	5E-07	0.1	None identified	None identified
07FWAMW69-6_0	5E-07	0.2	None identified	None identified
07FWCMW58-10_5	5E-07	0.1	None identified	None identified
08-FW-A-EXBLD26-05-6	5E-07	0.2	None identified	None identified
07FW-E-EX52-F344A	5E-07	0.03	None identified	None identified
07FW-E-EX52-F446A	5E-07	0.03	None identified	None identified
07FWBMW38-8_5	5E-07	0.2	None identified	None identified
06SI46S02	5E-07	0.1	None identified	None identified
08-FW-A-EXBLD22-01-3B	5E-07	0.09	None identified	None identified
07FWAMW47-10_4	5E-07	0.2	None identified	None identified
07FWBMW26-11_7	5E-07	0.1	None identified	None identified
06TP20S01	5E-07	0.3	None identified	None identified
07FW-A-EXBld15-01	5E-07	0.1	None identified	None identified
08-FW-A-EXBLD15-55-10_12	5E-07	0.1	None identified	None identified
06SB02S02	5E-07	0.1	None identified	None identified
04FHFW13SL	5E-07	0.01	None identified	None identified
07FWAMW69-10_0	5E-07	0.1	None identified	None identified
07FWBMW32-11	5E-07	0.1	None identified	None identified
07FWAMW68-3_0	5E-07	0.1	None identified	None identified
07FW-E-EX52-W319A	5E-07	0.03	None identified	None identified
07FW-A-EXBld48-20R1	5E-07	0.002	None identified	None identified
07FW-A-EXBld48-13R1	4E-07	0.002	None identified	None identified
04FHFW07SL	4E-07	0.009	None identified	None identified
07FW-A-EXBld17-05	4E-07	0.1	None identified	None identified
06SI22S01	4E-07	0.1	None identified	None identified
05FTW-A54-N6-24-48-SO	4E-07	0.03	None identified	None identified
07FWAMW51-7_5	4E-07	0.1	None identified	None identified
06TP05S02	4E-07	0.1	None identified	None identified
07FWBMW38-10_5	4E-07	0.1	None identified	None identified
04FHFW02SL	4E-07	0.009	None identified	None identified
07FWBMW27-10_5	4E-07	0.1	None identified	None identified
07FWAMW70-10	4E-07	0.1	None identified	None identified
07FWBMW33-12_5	4E-07	0.3	None identified	None identified
06SI25S01	4E-07	0.1	None identified	None identified
06SI21S01	4E-07	0.1	None identified	None identified
07FWAMW54-6_0	4E-07	0.2	None identified	None identified
07FWBMW25-10_5	4E-07	0.1	None identified	None identified
08-FW-A-EXBLD15-35-3_5	4E-07	0.1	None identified	None identified
07FW-A-EXBld48-23R1	4E-07	0.002	None identified	None identified
07FWAMW71-10	4E-07	0.1	None identified	None identified
08-FW-A-EXBLD22-39-8B	4E-07	0.05	None identified	None identified
07FW-A-EXBld48-21R1	4E-07	0.003	None identified	None identified
07FWAMW43-10_4	4E-07	0.1	None identified	None identified
07FWBMW28-10_5	4E-07	0.1	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-W208A	4E-07	0.02	None identified	None identified
05FTW-BHA54S2-24-48-SO	4E-07	0.02	None identified	None identified
07FW-E-EX52-F325A	4E-07	0.02	None identified	None identified
07FWAMW57-10_7	4E-07	0.08	None identified	None identified
07FW-E-EX52-F353A	4E-07	0.02	None identified	None identified
07FWAMW50-3_0	4E-07	0.1	None identified	None identified
07FWBMW23-10	4E-07	0.1	None identified	None identified
07FWDMW13-8_0	4E-07	0.1	None identified	None identified
07FWBMW28-8_5	4E-07	0.1	None identified	None identified
04FHFW63SO	4E-07	0.02	None identified	None identified
07FW-E-EX52-W314A	4E-07	0.02	None identified	None identified
08-FW-A-EXBLD26-07-3B	3E-07	0.1	None identified	None identified
07FW-E-EX52-F447A	3E-07	0.02	None identified	None identified
07FW-E-EX52-F109A	3E-07	0.02	None identified	None identified
07FW-E-EX52-FL01	3E-07	0.02	None identified	None identified
07FW-E-EX52-W317A	3E-07	0.02	None identified	None identified
07FW-E-EX52-W109C	3E-07	0.02	None identified	None identified
07FW-E-EX52-W405B	3E-07	0.02	None identified	None identified
07FW-E-EX52-F328A	3E-07	ND	None identified	None identified
05FTW-A51-S8-24-48-SO	3E-07	0.02	None identified	None identified
08-FW-A-EXBLD11-05-2_5	3E-07	0.2	None identified	None identified
07FW-E-EX52-F214A	3E-07	0.02	None identified	None identified
07FW-E-EX52-F304B	3E-07	0.01	None identified	None identified
09-FW-E-EXBLD50-06-4	2E-07	0.01	None identified	None identified
05FTW-A54-N14-24-48-SO	2E-07	0.01	None identified	None identified
07FW-E-EX52-F309A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F346A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F215A	2E-07	0.01	None identified	None identified
07FW-A-EXBLD4803-02	2E-07	0.004	None identified	None identified
07FW-E-EX52-W205A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F112A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F436A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F431AFD	2E-07	0.01	None identified	None identified
07FW-E-EX52-W431A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F430A	2E-07	0.01	None identified	None identified
07FWAMW43-3_0	2E-07	0.1	None identified	None identified
07FW-E-EX52-F306A	2E-07	0.01	None identified	None identified
07FW-E-EX52-F205A	2E-07	0.01	None identified	None identified
04FHFW81SO	2E-07	0.002	None identified	None identified
07FW-E-EX52-F326A	2E-07	0.01	None identified	None identified
07FW-E-EX52-FL03	2E-07	0.01	None identified	None identified
07FW-E-EX52-W410B	2E-07	0.009	None identified	None identified
07FW-E-EX52-W409B	2E-07	0.009	None identified	None identified
04FHFW70SO	1E-07	0.001	None identified	None identified
05FTW-A51-S6-24-48-SO	1E-07	0.008	None identified	None identified
07FW-E-EX52-NW05	1E-07	0.008	None identified	None identified
08-FW-A-EXBLD22-29-4B	1E-07	0.1	None identified	None identified
07FW-E-EX52-F209A	1E-07	0.008	None identified	None identified
08-FW-D-EXAREAD-21-4_6	1E-07	0.002	None identified	None identified
09-FW-E-EXBLD50-03-4	1E-07	0.008	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-W107A	1E-07	0.008	None identified	None identified
07FW-E-EX52-F111A	1E-07	0.008	None identified	None identified
07FWEMW20-2_5FD	1E-07	0.09	None identified	None identified
07FWEMW15-3_5B	1E-07	0.2	None identified	None identified
07FW-E-EX52-F348A	1E-07	0.007	None identified	None identified
07FW-E-EX52-FL07	1E-07	0.007	None identified	None identified
07FW-A-EXBLD4806	1E-07	0.1	None identified	None identified
05FTW-BHA22N2-24-48-SO	1E-07	0.007	None identified	None identified
07FW-E-EX52-F434B	1E-07	0.007	None identified	None identified
07FW-E-EX52-W903A	1E-07	0.007	None identified	None identified
07FWAMW41-3_0	1E-07	0.1	None identified	None identified
07FW-E-EX52-F303A	1E-07	0.007	None identified	None identified
08-FW-A-EXBLD15-34-2_4B	1E-07	0.00006	None identified	None identified
09-FW-E-EXBLD50-05-4	1E-07	0.006	None identified	None identified
07FW-A-EXTSA-05	1E-07	0.006	None identified	None identified
07FWAMW70-3_0	1E-07	0.0004	None identified	None identified
07FW-E-EX52-W207A	1E-07	0.006	None identified	None identified
07FW-C-EXDrum08R1	1E-07	0.0006	None identified	None identified
07FW-E-EX52-F114A	1E-07	0.006	None identified	None identified
07FW-E-EX52-F441A	1E-07	0.006	None identified	None identified
07FW-A-EXTSA-25	9E-08	0.005	None identified	None identified
07FW-E-EX52-W111A	9E-08	0.005	None identified	None identified
07FW-E-EX52-F204A	9E-08	0.005	None identified	None identified
07FW-E-EX52-F206A	9E-08	0.005	None identified	None identified
07FW-C-EXDrum09R1	9E-08	0.0005	None identified	None identified
09-FW-A-EXBLD15-32-11B	9E-08	0.2	None identified	None identified
05FTW-BHA31S1-24-48-SO	9E-08	0.005	None identified	None identified
09-FW-A-EXBLD49-02-11	8E-08	0.1	None identified	None identified
07FW-E-EX52-F440A	8E-08	0.005	None identified	None identified
07FW-C-EXDrum05R1	8E-08	0.0004	None identified	None identified
07FW-E-EX52-F703A	8E-08	0.004	None identified	None identified
07FW-E-EX52-FL09	8E-08	0.004	None identified	None identified
07FW-E-EX52-F103A	7E-08	0.004	None identified	None identified
07FW-E-EX52-NW01	7E-08	0.004	None identified	None identified
07FW-E-EX52-W401B	7E-08	0.004	None identified	None identified
07FW-E-EX52-F437A	7E-08	0.004	None identified	None identified
09-FW-A-EXBLD15-17-4B	7E-08	0.005	None identified	None identified
07FWBMW35-2_7FD	6E-08	0.0004	None identified	None identified
07FW-A-EXTSA-28	6E-08	0.004	None identified	None identified
07FW-E-EX52-W202A	6E-08	0.003	None identified	None identified
09-FCS-MW88-9	6E-08	0.0003	None identified	None identified
07FW-E-EX52-F106A	6E-08	0.003	None identified	None identified
07FW-E-EX52-W425B	6E-08	0.003	None identified	None identified
07FW-E-EX52-W430A	6E-08	0.003	None identified	None identified
09-FCS-MW86-9	6E-08	0.00007	None identified	None identified
07FW-E-EX52-F329A	5E-08	0.003	None identified	None identified
07FW-E-EX52-F445A	5E-08	0.003	None identified	None identified
07FW-A-EXBld4804R1	5E-08	0.0001	None identified	None identified
04FHFW72SO	5E-08	0.0004	None identified	None identified
07FWAMW61-3_0B	5E-08	0.07	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-F406BFD	5E-08	0.003	None identified	None identified
07FW-E-EX52-F901A	5E-08	0.003	None identified	None identified
07FWBMW65-3_5	4E-08	0.0005	None identified	None identified
07FWAMW46-3_0FD	4E-08	0.0004	None identified	None identified
08-FW-A-EXBLD22-39-8	4E-08	0.10	None identified	None identified
07FW-E-EX52-F213C	4E-08	0.002	None identified	None identified
06SI06S03	4E-08	0.0002	None identified	None identified
07FW-E-EX52-FL11	4E-08	0.002	None identified	None identified
07FW-A-EXBld4802R1	4E-08	0.00006	None identified	None identified
07FW-A-EXBld48-19	4E-08	0.0008	None identified	None identified
07FWAMW73-3_0	4E-08	0.2	None identified	None identified
07FW-E-EX52-F332A	3E-08	0.002	None identified	None identified
08-FW-E-EX52-F450	3E-08	0.002	None identified	None identified
08-FW-A-EXBLD15-26-2_4B	3E-08	0.0004	None identified	None identified
07FW-E-EX52-F448B	3E-08	0.002	None identified	None identified
09-FW-E-EXBLD54-02-3	3E-08	0.1	None identified	None identified
07FW-A-EXBld4805R1	3E-08	0.0005	None identified	None identified
07FW-E-EX52-W417C	3E-08	0.002	None identified	None identified
07FW-E-EX52-F336A	3E-08	0.003	None identified	None identified
06TP26S03	2E-08	0.0003	None identified	None identified
07FW-A-EXBld17-01B	2E-08	0.03	None identified	None identified
07FWBMW36-3_5FD	2E-08	0.02	None identified	None identified
07FWAMW62-6_0	2E-08	0.3	None identified	None identified
08-FW-A-EXBLD15-18-1_3B	2E-08	0.001	None identified	None identified
08-FW-A-EXBLD16-02-1_5	2E-08	0.03	None identified	None identified
07FW-A-EXBld15-10	2E-08	0.1	None identified	None identified
07FWEMW22-3_2FD	2E-08	0.0004	None identified	None identified
06SI08S03	2E-08	0.2	None identified	None identified
09-FW-A-EXBLD15-16-4B	2E-08	0.1	None identified	None identified
04FHFW67SO	1E-08	0.0002	None identified	None identified
06TP26S01	1E-08	0.0001	None identified	None identified
07FWBSB66-3_5	1E-08	0.0005	None identified	None identified
06TP19S01	1E-08	0.1	None identified	None identified
07FW-E-EX52-F115A	1E-08	0.0007	None identified	None identified
07FW-C-EXDrum03R1	1E-08	0.0004	None identified	None identified
03FHFW23SL	1E-08	0.0002	None identified	None identified
07FW-A-EXBld48-19R1B	1E-08	0.004	None identified	None identified
07FW-E-EX52-F433B	1E-08	0.0007	None identified	None identified
07FW-C-EXDrum06R1	1E-08	0.0005	None identified	None identified
07FW-C-EXDrum01R1B	9E-09	0.00009	None identified	None identified
09-FCS-MW85-14	8E-09	0.000009	None identified	None identified
08-FW-A-EXBLD22-13-3	6E-09	0.000001	None identified	None identified
05FTW-TSW-64-5-SO	6E-09	0.00003	None identified	None identified
03FHFW03SL	5E-09	0.00008	None identified	None identified
03FHFW05SL	5E-09	0.0001	None identified	None identified
04FHFW57SO	5E-09	0.00001	None identified	None identified
03FHFW27SL	5E-09	0.00009	None identified	None identified
03FHFW09SL	5E-09	0.00008	None identified	None identified
07FW-A-EXBld4808R1	5E-09	0.001	None identified	None identified
03FHFW04SL	4E-09	0.00008	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-A-EXBld4806R1	4E-09	0.00004	None identified	None identified
04FHFW51SO	4E-09	0.00002	None identified	None identified
03FHFW24SL	3E-09	0.00006	None identified	None identified
03FHFW12SL	3E-09	0.00005	None identified	None identified
03FHFW14SL	3E-09	0.00005	None identified	None identified
05FTW-BHA28S1-24-48-SO	3E-09	ND	None identified	None identified
03FHFW25SL	3E-09	0.00005	None identified	None identified
03FHFW21SL	3E-09	0.00005	None identified	None identified
03FHFW13SL	3E-09	0.00004	None identified	None identified
04FHFW53SO	2E-09	0.00001	None identified	None identified
08-FW-A-EXBLD24-18-8	2E-09	0.006	None identified	None identified
04FHFW55SO	2E-09	0.000009	None identified	None identified
07FWAMW61-3_0	2E-09	0.06	None identified	None identified
07FWAMW39-10_8	1E-09	0.03	None identified	None identified
07FW-C-EXDrum04R1	1E-09	0.0004	None identified	None identified
07FW-A-EXBld48-12	1E-09	0.04	None identified	None identified
07FWBMW29-2_5FD	4E-10	0.0003	None identified	None identified
08-FW-A-EXBLD12-08-5	4E-10	0.000003	None identified	None identified
09-FCS-MW87-14	4E-10	0.000009	None identified	None identified
09-FCS-MW90-5	3E-10	0.000003	None identified	None identified
09-FCS-MW90-14	3E-10	0.000003	None identified	None identified
09-FCSRI-SO-B9CS-01_3	2E-10	0.000002	None identified	None identified
09-FW-A-EXBLD11-10-5B	2E-10	0.00004	None identified	None identified
09-FCSRI-SO-B9CS-08_6	1E-10	0.000001	None identified	None identified
07FW-A-EXBld48-50	9E-11	0.003	None identified	None identified
07FWBMW26-3_2FD	7E-11	0.01	None identified	None identified
07FWDMW13-3_5	6E-11	0.0005	None identified	None identified
09-FCSRI-SO-B9CS-06B_6	5E-11	0.0000006	None identified	None identified
09-FCSRI-SO-B9CS-04_3	4E-11	0.0000005	None identified	None identified
09-FCSRI-SO-B9CS-02_3	4E-11	0.0000003	None identified	None identified
08-FW-A-EXBLD22-34-6B	9E-12	0.001	None identified	None identified
09-FW-E-EXBLD55-03-7	ND	0.3	None identified	None identified
07FW-C-EXDrum07-02	ND	0.1	None identified	None identified
06SI13S04	ND	0.07	None identified	None identified
06SI31S01	ND	0.06	None identified	None identified
05FTW-A56-N6-24-48-SO	ND	0.02	None identified	None identified
06SI12S03	ND	0.003	None identified	None identified
07FWAMW51-3_0FD	ND	0.001	None identified	None identified
04FHFW21SL	ND	0.0009	None identified	None identified
07FW-A-EXBld48-10R1	ND	0.0007	None identified	None identified
07FW-C-EXDrum01R1	ND	0.0004	None identified	None identified
04FHFW28SL	ND	0.0004	None identified	None identified
07FW-C-EXDrum07R1	ND	0.0004	None identified	None identified
07FW-C-EXDrum02R1	ND	0.0003	None identified	None identified
04FHFW01SL	ND	0.0003	None identified	None identified
06TP23S02	ND	0.0001	None identified	None identified
06SI18S03	ND	0.0001	None identified	None identified
07FW-A-EXBld48-17	ND	0.00002	None identified	None identified
09-FCSRI-SO-B9CS-07_6	ND	0.00001	None identified	None identified
09-FCSRI-SO-B9CS-10_15	ND	0.00001	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
06SI29S01	ND	0.000007	None identified	None identified
06SI35S01	ND	0.000006	None identified	None identified
06SI35S02	ND	0.000005	None identified	None identified
07FW-A-EXBld48-12R1B	ND	0.000004	None identified	None identified
06SI28S01	ND	0.000003	None identified	None identified
04FHFW79SO	ND	0.000001	None identified	None identified
09-FCSRI-SO-B9CS-05_3	ND	0.0000001	None identified	None identified
09-FCSRI-SO-B9CS-09_15	ND	0.0000001	None identified	None identified
09-FCSRI-SO-B9CS-06_6	ND	0.00000002	None identified	None identified
03FHFW07SL	ND	ND	None identified	None identified
03FHFW26SL	ND	ND	None identified	None identified
04FHFW12SL	ND	ND	None identified	None identified
04FHFW52SO	ND	ND	None identified	None identified
04FHFW54SO	ND	ND	None identified	None identified
04FHFW56SO	ND	ND	None identified	None identified
04FHFW58SO	ND	ND	None identified	None identified
04FHFW62SO	ND	ND	None identified	None identified
04FHFW64SO	ND	ND	None identified	None identified
04FHFW65SO	ND	ND	None identified	None identified
04FHFW66SO	ND	ND	None identified	None identified
04FHFW68SO	ND	ND	None identified	None identified
04FHFW69SO	ND	ND	None identified	None identified
04FHFW71SO	ND	ND	None identified	None identified
04FHFW73SO	ND	ND	None identified	None identified
04FHFW78SO	ND	ND	None identified	None identified
04FHFW80SO	ND	ND	None identified	None identified
04FHFW82SO	ND	ND	None identified	None identified
05FTW-A51-S10-24-48-SO	ND	ND	None identified	None identified
05FTW-A51-S4-24-48-SO	ND	ND	None identified	None identified
05-FTW-A51-W2-24-48-SO	ND	ND	None identified	None identified
05FTW-A52-SW10-24-48-SO	ND	ND	None identified	None identified
05FTW-A54-N10-24-48-SO	ND	ND	None identified	None identified
05FTW-A54-N8-24-48-SO	ND	ND	None identified	None identified
05FTW-A54-NW4-24-48-SO	ND	ND	None identified	None identified
05FTW-A56-N12-24-48-SO	ND	ND	None identified	None identified
05FTW-A56-N14-24-48-SO	ND	ND	None identified	None identified
05FTW-A56-N4-24-48-SO	ND	ND	None identified	None identified
05FTW-A56-N8-24-48-SO	ND	ND	None identified	None identified
05FTW-A56-NE16-24-48-SO	ND	ND	None identified	None identified
05FTW-A58-01-TSW-SO	ND	ND	None identified	None identified
05FTW-A59-03-TSW-SO	ND	ND	None identified	None identified
05FTW-BHA21N1-24-48-SO	ND	ND	None identified	None identified
05FTW-BHA28N2-24-48-SO	ND	ND	None identified	None identified
05FTW-BHA29N1-24-48-SO	ND	ND	None identified	None identified
05FTW-BHA29S2-24-48-SO	ND	ND	None identified	None identified
05FTW-BHA32S1-24-48-SO	ND	ND	None identified	None identified
05FTW-BHAPP7S2-24-48-SO	ND	ND	None identified	None identified
05FTW-BHLY-015-24-48-SO	ND	ND	None identified	None identified
05FTW-BHPP13N1-24-48-SO	ND	ND	None identified	None identified
05FTW-BHPP14N1-24-48-SO	ND	ND	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
05FTW-BHPP14N2-24-48-SO	ND	ND	None identified	None identified
06BERMS03	ND	ND	None identified	None identified
06BERMS04	ND	ND	None identified	None identified
06BERMS10	ND	ND	None identified	None identified
06BERMS11	ND	ND	None identified	None identified
06SI41S01	ND	ND	None identified	None identified
07FW-A-EXBld48-07	ND	ND	None identified	None identified
07FW-A-EXBld48-09	ND	ND	None identified	None identified
07FW-A-EXBld48-18	ND	ND	None identified	None identified
07FW-A-EXTSA-02	ND	ND	None identified	None identified
07FW-A-EXTSA-03	ND	ND	None identified	None identified
07FW-A-EXTSA-04	ND	ND	None identified	None identified
07FW-A-EXTSA-06	ND	ND	None identified	None identified
07FW-A-EXTSA-07	ND	ND	None identified	None identified
07FW-A-EXTSA-08	ND	ND	None identified	None identified
07FW-A-EXTSA-17	ND	ND	None identified	None identified
07FW-A-EXTSA-18	ND	ND	None identified	None identified
07FW-A-EXTSA-19	ND	ND	None identified	None identified
07FW-A-EXTSA-20	ND	ND	None identified	None identified
07FW-A-EXTSA-21	ND	ND	None identified	None identified
07FW-A-EXTSA-22	ND	ND	None identified	None identified
07FW-A-EXTSA-23	ND	ND	None identified	None identified
07FW-A-EXTSA-29	ND	ND	None identified	None identified
07FW-E-EX52-F101A	ND	ND	None identified	None identified
07FW-E-EX52-F102A	ND	ND	None identified	None identified
07FW-E-EX52-F104BFD	ND	ND	None identified	None identified
07FW-E-EX52-F105AFD	ND	ND	None identified	None identified
07FW-E-EX52-F107A	ND	ND	None identified	None identified
07FW-E-EX52-F108A	ND	ND	None identified	None identified
07FW-E-EX52-F113AFD	ND	ND	None identified	None identified
07FW-E-EX52-F114AFD	ND	ND	None identified	None identified
07FW-E-EX52-F201A	ND	ND	None identified	None identified
07FW-E-EX52-F203BFD	ND	ND	None identified	None identified
07FW-E-EX52-F205AFD	ND	ND	None identified	None identified
07FW-E-EX52-F207A	ND	ND	None identified	None identified
07FW-E-EX52-F208A	ND	ND	None identified	None identified
07FW-E-EX52-F210A	ND	ND	None identified	None identified
07FW-E-EX52-F211A	ND	ND	None identified	None identified
07FW-E-EX52-F212AFD	ND	ND	None identified	None identified
07FW-E-EX52-F301B	ND	ND	None identified	None identified
07FW-E-EX52-F302A	ND	ND	None identified	None identified
07FW-E-EX52-F305A	ND	ND	None identified	None identified
07FW-E-EX52-F307A	ND	ND	None identified	None identified
07FW-E-EX52-F308A	ND	ND	None identified	None identified
07FW-E-EX52-F310A	ND	ND	None identified	None identified
07FW-E-EX52-F311A	ND	ND	None identified	None identified
07FW-E-EX52-F312A	ND	ND	None identified	None identified
07FW-E-EX52-F313A	ND	ND	None identified	None identified
07FW-E-EX52-F314A	ND	ND	None identified	None identified
07FW-E-EX52-F315A	ND	ND	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-F316A	ND	ND	None identified	None identified
07FW-E-EX52-F317A	ND	ND	None identified	None identified
07FW-E-EX52-F318A	ND	ND	None identified	None identified
07FW-E-EX52-F319A	ND	ND	None identified	None identified
07FW-E-EX52-F320A	ND	ND	None identified	None identified
07FW-E-EX52-F321A	ND	ND	None identified	None identified
07FW-E-EX52-F322A	ND	ND	None identified	None identified
07FW-E-EX52-F323A	ND	ND	None identified	None identified
07FW-E-EX52-F324A	ND	ND	None identified	None identified
07FW-E-EX52-F327A	ND	ND	None identified	None identified
07FW-E-EX52-F334AFD	ND	ND	None identified	None identified
07FW-E-EX52-F335AFD	ND	ND	None identified	None identified
07FW-E-EX52-F338A	ND	ND	None identified	None identified
07FW-E-EX52-F339A	ND	ND	None identified	None identified
07FW-E-EX52-F340A	ND	ND	None identified	None identified
07FW-E-EX52-F341A	ND	ND	None identified	None identified
07FW-E-EX52-F342A	ND	ND	None identified	None identified
07FW-E-EX52-F343AFD	ND	ND	None identified	None identified
07FW-E-EX52-F347A	ND	ND	None identified	None identified
07FW-E-EX52-F350A	ND	ND	None identified	None identified
07FW-E-EX52-F351A	ND	ND	None identified	None identified
07FW-E-EX52-F407A	ND	ND	None identified	None identified
07FW-E-EX52-F409A	ND	ND	None identified	None identified
07FW-E-EX52-F410A	ND	ND	None identified	None identified
07FW-E-EX52-F411A	ND	ND	None identified	None identified
07FW-E-EX52-F415AFD	ND	ND	None identified	None identified
07FW-E-EX52-F416A	ND	ND	None identified	None identified
07FW-E-EX52-F417A	ND	ND	None identified	None identified
07FW-E-EX52-F418A	ND	ND	None identified	None identified
07FW-E-EX52-F419A	ND	ND	None identified	None identified
07FW-E-EX52-F420AFD	ND	ND	None identified	None identified
07FW-E-EX52-F421A	ND	ND	None identified	None identified
07FW-E-EX52-F422A	ND	ND	None identified	None identified
07FW-E-EX52-F423A	ND	ND	None identified	None identified
07FW-E-EX52-F424A	ND	ND	None identified	None identified
07FW-E-EX52-F425A	ND	ND	None identified	None identified
07FW-E-EX52-F426A	ND	ND	None identified	None identified
07FW-E-EX52-F427A	ND	ND	None identified	None identified
07FW-E-EX52-F428A	ND	ND	None identified	None identified
07FW-E-EX52-F429A	ND	ND	None identified	None identified
07FW-E-EX52-F432B	ND	ND	None identified	None identified
07FW-E-EX52-F435A	ND	ND	None identified	None identified
07FW-E-EX52-F438A	ND	ND	None identified	None identified
07FW-E-EX52-F439C	ND	ND	None identified	None identified
07FW-E-EX52-F443A	ND	ND	None identified	None identified
07FW-E-EX52-F701A	ND	ND	None identified	None identified
07FW-E-EX52-F702A	ND	ND	None identified	None identified
07FW-E-EX52-F801B	ND	ND	None identified	None identified
07FW-E-EX52-F802A	ND	ND	None identified	None identified
07FW-E-EX52-FL02	ND	ND	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
07FW-E-EX52-FL04FD	ND	ND	None identified	None identified
07FW-E-EX52-FL10	ND	ND	None identified	None identified
07FW-E-EX52-NW00FD	ND	ND	None identified	None identified
07FW-E-EX52-W102A	ND	ND	None identified	None identified
07FW-E-EX52-W103A	ND	ND	None identified	None identified
07FW-E-EX52-W108B	ND	ND	None identified	None identified
07FW-E-EX52-W112AFD	ND	ND	None identified	None identified
07FW-E-EX52-W203C	ND	ND	None identified	None identified
07FW-E-EX52-W204A	ND	ND	None identified	None identified
07FW-E-EX52-W206A	ND	ND	None identified	None identified
07FW-E-EX52-W209A	ND	ND	None identified	None identified
07FW-E-EX52-W210AFD	ND	ND	None identified	None identified
07FW-E-EX52-W211A	ND	ND	None identified	None identified
07FW-E-EX52-W213A	ND	ND	None identified	None identified
07FW-E-EX52-W215A	ND	ND	None identified	None identified
07FW-E-EX52-W216A	ND	ND	None identified	None identified
07FW-E-EX52-W301A	ND	ND	None identified	None identified
07FW-E-EX52-W302A	ND	ND	None identified	None identified
07FW-E-EX52-W303A-2B	ND	ND	None identified	None identified
07FW-E-EX52-W304A	ND	ND	None identified	None identified
07FW-E-EX52-W305A	ND	ND	None identified	None identified
07FW-E-EX52-W306A	ND	ND	None identified	None identified
07FW-E-EX52-W308A	ND	ND	None identified	None identified
07FW-E-EX52-W309A	ND	ND	None identified	None identified
07FW-E-EX52-W310A	ND	ND	None identified	None identified
07FW-E-EX52-W311A	ND	ND	None identified	None identified
07FW-E-EX52-W312A	ND	ND	None identified	None identified
07FW-E-EX52-W318B	ND	ND	None identified	None identified
07FW-E-EX52-W324A	ND	ND	None identified	None identified
07FW-E-EX52-W326A	ND	ND	None identified	None identified
07FW-E-EX52-W327A	ND	ND	None identified	None identified
07FW-E-EX52-W328A	ND	ND	None identified	None identified
07FW-E-EX52-W426C	ND	ND	None identified	None identified
07FW-E-EX52-W429AFD	ND	ND	None identified	None identified
07FW-E-EX52-W802BFD	ND	ND	None identified	None identified
07FW-E-EX52-W901A	ND	ND	None identified	None identified
07FW-E-EX52-W902A	ND	ND	None identified	None identified
07FW-E-EX52-W904A	ND	ND	None identified	None identified
07FW-E-EXSB105-F501	ND	ND	None identified	None identified
07FW-E-EXSB98-F601FD	ND	ND	None identified	None identified
07FW-E-EXSB98-F602	ND	ND	None identified	None identified
07FW-E-EXSB98-F605	ND	ND	None identified	None identified
08-FCS-BLD-040 F05	ND	ND	None identified	None identified
08-FCS-BLD-040 F08	ND	ND	None identified	None identified
08-FCS-BLD-040 NWW04	ND	ND	None identified	None identified
08-FCS-BLD-040 SEW07B	ND	ND	None identified	None identified
08-FCS-BLD-040 SWW06	ND	ND	None identified	None identified
08-FCS-BLD-040-SEW02	ND	ND	None identified	None identified
08FCS-BLD-40 NEW01	ND	ND	None identified	None identified
08-FW-A-EXBLD15-40-0-3	ND	ND	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
08-FW-A-EXBLD15-41-2-4	ND	ND	None identified	None identified
08FWAMW80-2_6	ND	ND	None identified	None identified
08-FW-E-EX52-F451	ND	ND	None identified	None identified
09-FCS-MW85-9	ND	ND	None identified	None identified
09-FCS-MW86-14	ND	ND	None identified	None identified
09-FCS-MW87-9	ND	ND	None identified	None identified
09-FCS-MW88-14	ND	ND	None identified	None identified
09-FCS-MW89-10	ND	ND	None identified	None identified
09-FCSRI-SO-B9CS-011_5	ND	ND	None identified	None identified
09-FCSRI-SO-B9CS-03_3	ND	ND	None identified	None identified
09-FCSRI-SO-SB01-12-14	ND	ND	None identified	None identified
09-FCSRI-SO-SB01-4-6	ND	ND	None identified	None identified
09-FCSRI-SO-SB02-10-12	ND	ND	None identified	None identified
09-FCSRI-SO-SB02-2-4	ND	ND	None identified	None identified
09-FCSRI-SO-SB03-10-12	ND	ND	None identified	None identified
09-FCSRI-SO-SB03-6-8	ND	ND	None identified	None identified
09-FCSRI-SO-SB04-2-4	ND	ND	None identified	None identified
09-FCSRI-SO-SB04-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB05-10-12	ND	ND	None identified	None identified
09-FCSRI-SO-SB05-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB06-09-11	ND	ND	None identified	None identified
09-FCSRI-SO-SB06-4-6	ND	ND	None identified	None identified
09-FCSRI-SO-SB07-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB08-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB08A-6-8	ND	ND	None identified	None identified
09-FCSRI-SO-SB09-9-11	ND	ND	None identified	None identified
09-FCSRI-SO-SB09A-6-8	ND	ND	None identified	None identified
09-FCSRI-SO-SB10-2-4	ND	ND	None identified	None identified
09-FCSRI-SO-SB10-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB11-6-8	ND	ND	None identified	None identified
09-FCSRI-SO-SB11-8-10	ND	ND	None identified	None identified
09-FCSRI-SO-SB12-10-12	ND	ND	None identified	None identified
09-FCSRI-SO-SB12-6-8	ND	ND	None identified	None identified
09-FCSRI-SO-SB13-4-6	ND	ND	None identified	None identified
09-FCSRI-SO-SB13-9-11	ND	ND	None identified	None identified
09-FW-E-EXBLD50-02-5	ND	ND	None identified	None identified
09-FW-E-EXBLD50-04-5	ND	ND	None identified	None identified
09-FW-E-EXBLD50-07-4	ND	ND	None identified	None identified
09-FW-E-EXBLD50-08-4	ND	ND	None identified	None identified
09-FW-E-EXBLD50-09-4	ND	ND	None identified	None identified
09-FW-E-EXBLD50-10-4	ND	ND	None identified	None identified
09-FW-E-EXBLD51-02-5	ND	ND	None identified	None identified
09-FW-E-EXBLD51-03-4	ND	ND	None identified	None identified
09-FW-E-EXBLD51-04-5	ND	ND	None identified	None identified
09-FW-E-EXBLD51-05-4	ND	ND	None identified	None identified
09-FW-E-EXBLD51-06-4	ND	ND	None identified	None identified
09-FW-E-EXBLD51-07-5	ND	ND	None identified	None identified
09-FW-E-EXBLD51-08-5	ND	ND	None identified	None identified
09-FW-E-EXBLD51-09-5	ND	ND	None identified	None identified
09-FW-E-EXBLD51-10-4	ND	ND	None identified	None identified

TABLE 7-11
Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)
Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
09-FW-E-EXBLD53-02-3	ND	ND	None identified	None identified
09-FW-E-EXBLD53-04-3	ND	ND	None identified	None identified
09-FW-E-EXBLD53-08-3	ND	ND	None identified	None identified
09-FW-E-EXBLD53-09-4	ND	ND	None identified	None identified
09-FW-E-EXBLD54-01-4	ND	ND	None identified	None identified
09-FW-E-EXBLD54-03-3	ND	ND	None identified	None identified
09-FW-E-EXBLD54-04-3	ND	ND	None identified	None identified
09-FW-E-EXBLD54-05-5	ND	ND	None identified	None identified
09-FW-E-EXBLD54-06-4	ND	ND	None identified	None identified
09-FW-E-EXBLD54-07-4	ND	ND	None identified	None identified
09-FW-E-EXBLD54-08-4	ND	ND	None identified	None identified
09-FW-E-EXBLD54-09-3	ND	ND	None identified	None identified
09-FW-E-EXBLD54-10-5	ND	ND	None identified	None identified
09-FW-E-EXBLD55-02-5	ND	ND	None identified	None identified
09-FW-E-EXBLD55-04-6	ND	ND	None identified	None identified
09-FW-E-EXBLD55-05-6	ND	ND	None identified	None identified
09-FW-E-EXBLD55-06-10	ND	ND	None identified	None identified
09-FW-E-EXBLD55-07-6	ND	ND	None identified	None identified
09-FW-E-EXBLD55-08-5	ND	ND	None identified	None identified
09-FW-E-EXBLD55-09-5	ND	ND	None identified	None identified
09-FW-E-EXBLD55-10-9	ND	ND	None identified	None identified
09-FW-E-EXBLD56-02-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-03-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-04-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-05-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-06-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-07-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-08-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-09-3	ND	ND	None identified	None identified
09-FW-E-EXBLD56-10-3	ND	ND	None identified	None identified
09-FW-E-EXBLD57-02-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-03-4	ND	ND	None identified	None identified
09-FW-E-EXBLD57-04-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-05-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-06-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-07-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-08-4	ND	ND	None identified	None identified
09-FW-E-EXBLD57-09-5	ND	ND	None identified	None identified
09-FW-E-EXBLD57-10-4	ND	ND	None identified	None identified
09-FW-E-EXBLD58-02-4	ND	ND	None identified	None identified
09-FW-E-EXBLD58-03-5	ND	ND	None identified	None identified
09-FW-E-EXBLD58-04-5	ND	ND	None identified	None identified
09-FW-E-EXBLD58-05-4	ND	ND	None identified	None identified
09-FW-E-EXBLD58-06-4	ND	ND	None identified	None identified
09-FW-E-EXBLD58-07-3	ND	ND	None identified	None identified
09-FW-E-EXBLD58-08-4	ND	ND	None identified	None identified
09-FW-E-EXBLD58-09-3	ND	ND	None identified	None identified
09-FW-E-EXBLD58-10-4	ND	ND	None identified	None identified
09-FW-E-EXBLD59-01-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-03-3	ND	ND	None identified	None identified

TABLE 7-11

Summary of Risk and Hazard Estimates for Subsurface Soil (2-15 ft bgs)

Hypothetical Future Unrestricted Exposure Scenario: Sample-Specific Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Location	Excess Lifetime Cancer Risk [a]	Noncancer Hazard Index	Primary Contributors to Cancer Risk [b]	Primary Contributors to Hazard Index [b]
09-FW-E-EXBLD59-04-4	ND	ND	None identified	None identified
09-FW-E-EXBLD59-05-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-06-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-07-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-08-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-09-3	ND	ND	None identified	None identified
09-FW-E-EXBLD59-10-3	ND	ND	None identified	None identified
1195-1-3	ND	ND	None identified	None identified
1195-2-3	ND	ND	None identified	None identified
1195-5-3	ND	ND	None identified	None identified
1195-5-4	ND	ND	None identified	None identified

Minimum	9E-12	0.00000002
Maximum	8E-05	5
Average	1E-06	0.2

a. Values presented on this table are sorted by decreasing excess lifetime cancer risk. Sorting was not conducted for noncancer risks since all hazard index values except for sample 06TP19S02 were well below 1.

b. Primary contributors to the total risk are listed when ELCR > 10^{-5} or HI > 1.0.

TABLE 7-12
Summary of Risk and Hazard Estimates for Domestic Use of Groundwater
Hypothetical Future Unrestricted Exposure Scenario: Non-Capture Zone Wells Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Well ID	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
MW03	8E-04	--	4	Arsenic 99% Vinyl Chloride 0.7%	Arsenic 97%
MW61	6E-04	2E-04	2	Trichloroethene 70% 1,1,2,2-Tetrachloroethane 26% Vinyl Chloride 4% 1,1,2-Trichloroethane 0.5% Tetrachloroethene 0.3%	Trichloroethene 85%
MW56	5E-04	1E-04	2	Trichloroethene 76% Vinyl Chloride 12% 1,1,2,2-Tetrachloroethane 10% Tetrachloroethene 2%	Trichloroethene 78% Cobalt 18%
MW13	3E-04	3E-04	1	1,2,3-Trichloropropane 100%	None identified
MW32	2E-04	--	0.8	1,2,3-Trichloropropane 96% Vinyl Chloride 4%	None identified
MW62	1E-04	9E-05	1	Dibenzo(a,h)anthracene 39% Trichloroethene 31% Benzo(a)pyrene 17% Vinyl Chloride 7% Indeno(1,2,3-cd)pyrene 2% 1,1,2,2-Tetrachloroethane 2% Benzo(b)fluoranthene 1%	None identified
MW77	1E-04	7E-05	3	Naphthalene 52% Trichloroethene 44% 1,1,2,2-Tetrachloroethane 2%	Naphthalene 49%
MW43	7E-05	9E-06	0.6	Trichloroethene 91% Vinyl Chloride 6%	None identified
MW06A	6E-05	6E-05	4	1,2,3-Trichloropropane 40% Heptachlor 28% Vinyl Chloride 12% Naphthalene 8% RDX 4% 1,1,2,2-Tetrachloroethane 3% Trichloroethene 3%	MCPP 61%
MW64	5E-05	1E-05	0.4	Trichloroethene 84% Vinyl Chloride 16%	None identified
MW26	5E-05	--	0.6	1,2,3-Trichloropropane 60% Vinyl Chloride 40%	None identified

TABLE 7-12
Summary of Risk and Hazard Estimates for Domestic Use of Groundwater
Hypothetical Future Unrestricted Exposure Scenario: Non-Capture Zone Wells Sorted from Higher to Lower Risk
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Well ID	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
MW33	5E-05	--	2	Heptachlor 53% 1,1,2,2-Trichloroethane 13% Vinyl Chloride 13% RDX 8% 1,1,2-Trichloroethane 7% Naphthalene 6%	Iron 80%
MW07	5E-05	--	0.2	1,2,3-Trichloropropane 92% Vinyl Chloride 8%	None identified
MW69	5E-05	--	1	Dibenzo(a,h)anthracene 38% Benzo(a)pyrene 24% Benzene 14% Ethylbenzene 8% Vinyl Chloride 7% Indeno(1,2,3-cd)pyrene 4%	None identified
MW17	5E-05	--	2	Naphthalene 95%	Naphthalene 60% Cobalt 40%
MW65	4E-05	--	3	None identified	Iron 37% Cobalt 33% 1,3,5-Trimethylbenzene 17%
MW12	4E-05	--	16	Dieldrin 37% Naphthalene 18% Vinyl Chloride 18% 1,1,2,2-Trichloroethane 17% RDX 10%	MCPP 55% MCPA 36%
MW48	4E-05	4E-05	0.5	1,2,3-Trichloropropane 92% bis(2-Ethylhexyl)phthalate 5%	None identified
MW40	4E-05	4E-05	0.06	1,2,3-Trichloropropane 70% Vinyl Chloride 26%	None identified
MW36	3E-05	--	5	Naphthalene 99%	Cobalt 60% Naphthalene 18%
MW16	3E-05	--	2	Naphthalene 100%	Iron 82%
MW05	2E-05	--	0.5	Naphthalene 100%	None identified
MW38	2E-05	4E-06	0.4	Trichloroethene 83% Vinyl Chloride 16%	None identified
MW09	2E-05	--	2	Naphthalene 100%	Cobalt 96%
MW34	1E-05	--	0.5	Naphthalene 100%	None identified
MW44	1E-05	--	2	Trichloroethene 100%	Cobalt 96%
MW53	1E-05	--	0.6	Trichloroethene 34% Vinyl Chloride 32% bis(2-Ethylhexyl)phthalate 19%	None identified
MW57	9E-06	--	0.8	Naphthalene 41% bis(2-Ethylhexyl)phthalate 22%	None identified

TABLE 7-12

Summary of Risk and Hazard Estimates for Domestic Use of Groundwater

Hypothetical Future Unrestricted Exposure Scenario: Non-Capture Zone Wells Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Well ID	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
MW70	6E-06	--	2	1,2-Dichloroethane 41% bis(2-Ethylhexyl)phthalate 29%	Cobalt 68%
MW58	6E-06	--	0.6	Vinyl Chloride 73%	None identified
MW81	4E-06	--	0.9	Vinyl Chloride 98%	None identified
MW80	4E-06	--	0.02	Vinyl Chloride 70%	None identified
MW82	4E-06	--	0.0005	Vinyl Chloride 100%	None identified
MW83	3E-06	--	0.005	Chloroform 100%	None identified
MW37	3E-06	--	0.05	Vinyl Chloride 95%	None identified
MW35	3E-06	--	0.3	Vinyl Chloride 94%	None identified
MW45	3E-06	--	0.5	Vinyl Chloride 100%	None identified
MW63	2E-06	--	0.6	Trichloroethene 100%	None identified
MW25	1E-06	--	0.1	None identified	None identified
MW20	8E-07	--	0.4	None identified	None identified
MW73	8E-07	--	0.4	None identified	None identified
MW76	4E-07	--	0.6	None identified	None identified
MW67	1E-07	--	0.2	None identified	None identified
MW46	1E-07	--	0.4	None identified	None identified
MW51	1E-07	--	1	None identified	None identified
MW10	1E-07	--	0.3	None identified	None identified
MW01	9E-08	--	0.2	None identified	None identified
MW74	7E-08	--	0.2	None identified	None identified
MW55	3E-08	--	1	None identified	None identified
MW49	2E-08	--	0.4	None identified	None identified
MW21	1E-08	--	0.3	None identified	None identified
MW29	1E-08	--	0.2	None identified	None identified
MW31	1E-08	--	0.5	None identified	None identified
MW27	1E-08	--	0.2	None identified	None identified
MW19	9E-09	--	0.7	None identified	None identified
MW30	9E-09	--	0.3	None identified	None identified
MW50	ND	--	2	None identified	Cobalt 92%
MW18	ND	--	1	None identified	None identified
MW60	ND	--	0.9	None identified	None identified
MW02	ND	--	0.9	None identified	None identified
MW14	ND	--	0.7	None identified	None identified
MW23	ND	--	0.6	None identified	None identified
MW15	ND	--	0.6	None identified	None identified
MW71	ND	--	0.5	None identified	None identified
MW72	ND	--	0.5	None identified	None identified
MW59	ND	--	0.4	None identified	None identified
MW22	ND	--	0.4	None identified	None identified
MW04	ND	--	0.4	None identified	None identified
MW42	ND	--	0.4	None identified	None identified
MW41	ND	--	0.3	None identified	None identified
MW24	ND	--	0.2	None identified	None identified
MW68	ND	--	0.1	None identified	None identified

TABLE 7-12

Summary of Risk and Hazard Estimates for Domestic Use of Groundwater

Hypothetical Future Unrestricted Exposure Scenario: Non-Capture Zone Wells Sorted from Higher to Lower Risk

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Well ID	Excess Lifetime Cancer Risk Using ADEC Slope Factor for TCE	Excess Lifetime Cancer Risk Using USEPA Draft Slope Factor for TCE	Noncancer Hazard Index	Primary Contributors to Cancer Risk [a]	Primary Contributors to Hazard Index [a]
MW28	ND	--	0.1	None identified	None identified
MW52	ND	--	0.06	None identified	None identified
MW54	ND	--	0.005	None identified	None identified
MW11	ND	--	ND	None identified	None identified

Notes:

a. Primary contributors to the total risk are listed when ELCR > 10^{-5} (using ADEC slope for TCE) or HI > 1.0.

ND = No carcinogenic or noncarcinogenic constituents detected

TCE = Trichloroethene

TABLE 7-13

Summary of Multi-Media Risk and Hazard Estimates for the Hypothetical Future Unrestricted Exposure Scenario

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Exposure Scenario and Medium	Exposure Route	Excess Lifetime Cancer Risk	Noncancer Hazard Index
Hypothetical Unrestricted Use (Maximum Location) - Direct Contact with Soil (0-15 ft bgs)	Ingestion	8x10-5	5
	Dermal	5x10-8	0.0003
	Inhalation	7x10-7	0.1
	Total	8x10-5 [a]	5 [a]
Hypothetical Unrestricted Use (Maximum Location) - Vapor Intrusion to Indoor Air	Inhalation	6x10-6 [b]	0.05 [b]
Hypothetical Unrestricted Use - Domestic Use of Groundwater	Ingestion	2x10-3	16
	Dermal	1x10-5	0.007
	Inhalation	4x10-7	0.2
	Total	2x10-3 [c]	16 [c]
Cumulative Multi-Media Risk and Hazard [d]		2x10-3	21

Notes:

a. Subsurface soil direct contact values represent the maximum risk (08-FW-A-EXBLD24-19-4) and hazard (06TP19S02) estimates from any single sample across the entire FCS.

b. Vapor intrusion values represent the maximum risk (SG012-L) and hazard (SG034-L) estimates from any single subslab location across the entire FCS.

c. Groundwater use values represent the maximum risk (MW79) and hazard (MW12) estimates from any monitoring well across the entire FCS.

d. The risk drivers for the maximum risk sample selected for the multi-media risk estimates are provided in Tables 7-11 and 7-12 for soil and groundwater, respectively.

TABLE 7-14
Drainage Swale Sediment Ecological Screening Evaluation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Chemical	Alaska DEC Scoping			NOAA Sediment Quality Guidelines		Consensus Freshwater Benchmarks		EPA Ecological Soil Screening Level (EcoSSL)				Drainage Swale Samples (mg/kg)			
	Listed as Potentially Bioaccumulative	Soil ERBSC (mg/kg)	Identified as COPEC	Threshold Effects Level (mg/kg)	Probable Effects Level (mg/kg)	Threshold Effects Concentration (mg/kg)	Probable Effects Concentration (mg/kg)	Birds (mg/kg)	Mammals (mg/kg)	Maximum Detected Concentration (mg/kg)	Background Concentration[a] (mg/kg)	DSS01-01 9/21/2007	DSS01-02 9/21/2007	DSS01-03 9/21/2007	DSS01-03 (FD) 9/21/2007
METALS															
Aluminum	--	5.0	√	--	--	--	--	--	--	13900	--	12300	10400		13900
Antimony	--	0.27	√	--	--	--	--	--	0.27	*1.8*	--	1.8 J-	0.72	0.83	
Arsenic	√	0.25	√	5.9	17	9.8	33	43	46	25.5	8.5	25.5 J-	8.2 J		19.7 J
Barium	--	5.0	√	--	--	--	--	--	2000	304	85	260	202		304
Beryllium	--	2.42	--	--	--	--	--	--	21	0.34	--	0.33	0.22		0.34
Boron	--	0.5	√	--	--	--	--	--	--	3	--	2.8 J	2.9 J	3 J	
Cadmium	√	0.2	√	0.596	3.53	0.99	4.98	0.77	0.36	*0.67*	0.58	0.6	0.67	0.54	
Chromium	--	64	--	37.3	90	43.4	111	26	34	*33.9*	14.6	32.7	25.2		33.9
Cobalt	--	13	√	--	--	--	--	120	230	16.7	--	16.3	9.3		16.7
Copper	√	1.0	√	35.7	197	31.6	149	28	49	*55.1*	--	55.1	31.8	46.4	
Iron	--	--	--		--	--	--	--	--	39100	--	39100	21400		36900
Lead	√	9.36	√	35	91.3	35.8	128	11	56	*60*	11.4	32.8 J-	60	31.5	
Manganese	--	100	√	--	--	--	--	4300	4000	787	--	787	377		712
Mercury	√	0.3	√	0.174	0.486	0.18	1.06	--	--	0.1	--	0.1	0.05 J	0.068 J	
Nickel	√	25	√	18	35.9	22.7	49	210	130	39.3	--	38.2	23.7		39.3
Selenium	√	0.02	√	--	--	--	--	1.20	0.63	*0.93*	--	0.93	0.47	0.69	
Silver	√	2.0	√	--	--	--	--	4.2	14	0.2	--	0.2 J-	0.15 J-		0.2 J-
Thallium	--	0.01	√	--	--	--	--	--	--	0.2	--	0.2	0.11 J		0.2
Vanadium	--	2.0	√	--	--	--	--	7.8	280	*49.5*	--	49.5	30.5		47.1
Zinc	√	0.9	√	123.1	315	121	459	46	79	*252*	--	149 J-	252 J-	197 J-	
PAH															
Fluoranthene	√	260	√	0.111	2.355	0.423	2.23	--	1.0	0.064	--	2.3 U	1.5 U		0.064 J-
Phenanthrene	--	0.1	--	0.042	0.515	0.204	1.17	--	1.0	0.035	--	2.3 U	1.5 U		0.035 J-
Pyrene	√	0.1	√	0.053	0.875	0.195	1.52	--	1.0	0.059	--	2.3 U	1.5 U		0.059 J-
PESTICIDES															
4,4'-DDD	√	34	√	0.004	0.009	0.0049	0.0280	0.093	0.021	0.0069	--	0.005 J+	0.0048 J+		0.0069 J+
4,4'-DDE	√	1.3	√	0.001	0.007	0.0032	0.0313	0.093	0.021	*0.036*	--	0.036 J+	0.0035 J+		0.01 J+
4,4'-DDT	√	0.7	√	0.001	0.005	0.0042	0.0629	0.093	0.021	*0.16*	--	0.16 J+	0.008 J+		0.023 J
alpha-BHC	√	17	√	--	--	--	--	--	--	0.0014	--	0.0037 U	0.00098 J		0.0014 J
beta-BHC	√	7.3	√	--	--	--	--	--	--	0.00084	--	0.0037 U	0.0025 U		0.00084 J
Dieldrin	√	0.01	√	0.0029	0.0067	0.0019	0.0618	0.0220	0.0049	0.003	--	0.003 J	0.0011 J		0.0017 J
gamma-BHC (Lindane)	√	1.2	√	0.0009	0.0014	0.0024	0.0050	--	--	0.00077	--	0.00077 J	0.0025 U		0.0033 U
Heptachlor epoxide	√	4.0	√	0.0006	0.0027	0.0025	0.0160	--	--	0.0011	--	0.0011 J	0.00054 J		0.00031 J
SVOC															
Benzyl butyl phthalate	√	48	√	--	--	--	--	--	--	0.055	--	0.7 UJ	0.055 J-		0.048 J-
bis-(2-Ethylhexyl)phthalate	√	0.9	√	--	--	--	--	--	--	0.52	--	0.17 J-	0.41 J-		0.52 J-
TPH															
TPH-Diesel	--	--	--	--	--	--	--	--	--	62	--	44	62	60 J	
TPH-Gasoline	--	--	--	--	--	--	--	--	--	11	--	11 U	8 U		10 U
TPH-Motor Oil	--	--	--	--	--	--	--	--	--	490	--	400	490	490 J	
VOC															
2-Butanone	--	--	--	--	--	--	--	--	--	0.1	--	0.078 J	0.063 J	0.1 J	
4-Isopropyltoluene	--	--	--	--	--	--	--	--	--	0.041	--	0.01 U	0.0062 U	0.041 J	
Acetone	--	--	--	--	--	--	--	--	--	0.51	--	0.51	0.11 U	0.44 J	
Chloroform	--	150	--	--	--	--	--	--	--	0.12	--	0.017 J	0.12	0.023 J	
Trichlorofluoromethane	--	--	--	--	--	--	--	--	--	0.26	--	0.26	0.0062 U	0.0087 U	

Notes:
Bold indicates maximum detected concentration exceeds the soil benchmark from DEC Scoping Guidance
Shading indicates maximum detected concentration exceeds the sediment PEL
Italics indicates maximum detected concentration exceeds either the bird or mammal EcoSSL
None of the maximum detected concentrations exceed the sediment PEC

[a] Source: Recommended background values for Fort Wainwright South of the Chena River (US Army 1994)

TABLE 7-15
Groundwater Ecological Screening Evaluation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Overall Maximum Detect (ug/L)	2007 Maximum Detect (ug/L)	2008 Maximum Detect (ug/L)	2009 Maximum Detect (ug/L)
EXPLOSIVES												
1,3,5-Trinitrobenzene	270	--	--	--	--	--	--	--	0.039	ND	0.039	ND
RDX	--	--	--	--	--	--	--	--	0.064	ND	0.064	ND
METALS												
Aluminum	75	√	750	87	--	√	7,538	--	98.8	98.8	44.9	ND
Antimony	30	--	--	--	--	--	--	--	3.8	3.4	3.8	1.76
Arsenic	55	--	340	150	--	--	36	--	16.9	3.6	16.9	15.6
Barium	3.9	√	--	--	--	--	551	--	257	239	257	253
Boron	1.6	√	--	--	--	--	--	√	200	200	63.4	105
Calcium	116,000	√	--	--	--	--	--	√	208,000	120,000	208,000	140,000
Cobalt	3.0	√	--	--	--	--	--	√	23.4	8.1	23.4	21.9
Copper	0.205	√	13	9.0	--	√	--	√	9.6	4.5	9.6	5.68
Iron	16	√	--	1000	--	√	16,938	--	7,490	6,720	7,490	7,360
Lead	1		--	--	--	--	34.07	--	0.35	ND	ND	0.35
Magnesium	82,000	√	--	--	--	--	--	√	85,800	30,300	85,800	56,900
Manganese	80	√	--	--	--	--	3,875	--	1,940	1,020	1,650	1,940
Nickel	5.0	√	470	52	--	√	--	√	98.6	43.6	98.6	88.1
Potassium	530,000	--	--	--	--	--	--	--	9,710	7,430	8,690	9,710
Selenium	1.0	√	12.8	5.0	√	√	--	√	17.9	8.2	10	17.9
Sodium	680,000	--	--	--	--	--	--	--	11,900	11,100	11,700	11,900
Thallium	0.8	--	--	--	--	--	--	--	0.6	0.6	ND	ND
Vanadium	19	--	--	--	--	--	--	--	9.7	4.8	8	9.7
Zinc	21	--	120	120	--	--	--	--	13.6	ND	8.6	13.6
PAH												
2-Methylnaphthalene	--	--	--	--	--	--	--	--	5.9	ND	5.9	0.0221
Acenaphthene	5.8	--	--	--	--	--	--	--	0.2	ND	0.2	0.0461
Acenaphthylene	--	--	--	--	--	--	--	--	0.094	ND	0.094	ND
Fluorene	3	--	--	--	--	--	--	--	0.42	ND	0.42	0.0747
Naphthalene	1.1	√	--	--	--	--	--	√	8.8	4.9	8.8	0.2
Phenanthrene	0.4	--	--	--	--	--	--	--	0.2	ND	0.2	ND
PESTICIDES												
4,4'-DDT	0.000011	√	1.1	0.001	--	√	--	√	0.013	0.013	ND	ND
alpha-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0066	ND	0.0066	ND
gamma-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0093	ND	0.0093	ND

TABLE 7-15
Groundwater Ecological Screening Evaluation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L) MW35					MW36				
									10/16/2007	5/21/2008	10/5/2008	6/1/2009	9/20/2009	10/15/2007	5/17/2008	10/5/2008	6/1/2009	9/20/2009
EXPLOSIVES																		
1,3,5-Trinitrobenzene	270	--	--	--	--	--	--	--	0.017 UJ	0.017 U	0.017 U	0.016 U	0.016 U	0.017 U	0.017 U	0.017 U	0.017 U	0.016 U
RDX	--	--	--	--	--	--	--	--	0.021 UJ	0.021 U	0.021 U	0.02 U	0.02 U	0.021 U	0.021 U	0.021 U	0.02 U	0.02 U
METALS																		
Aluminum	75	√	750	87	--	√	7,538	--	35 U	35 U	44.9 J	62 U	150 U	36.8 J	35 U	35 U	62 U	150 U
Antimony	30	--	--	--	--	--	--	--	2 U	2 U	2 U	0.31 U	0.31 U	3.4 J	3.1 J	3.8 J	0.31 U	1.76
Arsenic	55	--	340	150	--	--	36	--	1 U	1 U	1 U	1.5 U	1.5 U	1.2 J	2.1 J	2.6 J	2.45 J	1.5 U
Barium	3.9	√	--	--	--	--	551	--	130	106	185	108	98.2	79.5	68.4	57.7	60.6	35.1
Boron	1.6	√	--	--	--	--	--	√	10 U	10 U	10 U	73.4 J	62 U	200 J	10 U	63.4 J	105 J	62 U
Calcium	116,000	√	--	--	--	--	--	√	120,000 J+	99,400	136,000	100,000	96,400	78,200 J+	83,400	88,400	95,600	65,100
Cobalt	3.0	√	--	--	--	--	--	√	1.5 J	1.3 J	1 U	1.06	0.91 J	8.1	22.8	23.4	21.9	12.2
Copper	0.205	√	13	9.0	--	√	--	√	2.5 J	2.5 J	2.9 J	3.1 U	2.58 J	4.5	6.5	7.8	3.1 U	5.68 J
Iron	16	√	--	1000	--	√	16,938	--	45.2 J	28.3 J	16 U	62 U	310 U	100 J	34.9 J	16.0 U	62 U	310 U
Lead	1		--	--	--	--	34.07	--	0.6 U	0.6 U	0.6 U	0.31 U	0.31 U	0.6 U	0.6 U	0.6 U	0.31 U	0.31 U
Magnesium	82,000	√	--	--	--	--	--	√	30,300	24,100	33,400	25,300	23,600 J+	17,100	19,300	19,000	22,900	14,700
Manganese	80	√	--	--	--	--	3,875	--	177	187	39	178 J+	126	55	24	5 J	3 U	5
Nickel	5.0	√	470	52	--	√	--	√	8.1	6.5	1.5 J	8.66	6.25	43.6	98.6	96.5	88.1	45.1
Potassium	530,000	--	--	--	--	--	--	--	6,530	5,140	7,230	5,530	5,080	5,790	5,670	6,520	5,960	4,470
Selenium	1.0	√	12.8	5.0	√	√	--	√	4.9	1.2 J	8.2	1.34 J	0.62 U	8.2	10	9.2	17.9	4.27
Sodium	680,000	--	--	--	--	--	--	--	6,580	6,480	8,240	7,070	6,080	6,370	7,230	6,970	7,470	5,410
Thallium	0.8	--	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	0.78 U	0.78 U	0.6 J	0.5 U	0.5 U	0.78 U	0.78 U
Vanadium	19	--	--	--	--	--	--	--	4 U	4 U	4 U	6.2 U	6.2 U	4.8 J	5 J	8 J	9.7 J	6.2 U
Zinc	21	--	120	120	--	--	--	--	4 U	4 U	4 U	6.2 U	13.6 J	4 U	5.7 J	4 U	6.2 U	7.99 J
PAH																		
2-Methylnaphthalene	--	--	--	--	--	--	--	--	0.0027 UJ	0.0058 U	0.0057 U	0.0184 J	0.0161 U	0.0049 J	0.0054 U	0.0057 U	0.0167 U	0.016 U
Acenaphthene	5.8	--	--	--	--	--	--	--	0.0031 UJ	0.0034 U	0.0033 U	0.0163 U	0.0161 U	0.0031 U	0.0031 U	0.0033 U	0.0167 U	0.016 U
Acenaphthylene	--	--	--	--	--	--	--	--	0.003 UJ	0.0033 U	0.0032 U	0.0163 U	0.0161 U	0.003 U	0.003 U	0.0032 U	0.0167 U	0.016 U
Fluorene	3	--	--	--	--	--	--	--	0.004 UJ	0.0043 U	0.0042 U	0.0163 U	0.0161 U	0.004 U	0.004 U	0.0042 U	0.0167 U	0.016 U
Naphthalene	1.1	√	--	--	--	--	--	√	0.0012 U	0.0039 U	0.0066 J	0.0337 U	0.0333 U	4.9 J	0.0036 U	0.0038 U	0.0344 U	0.0332 U
Phenanthrene	0.4	--	--	--	--	--	--	--	0.0063 UJ	0.0067 U	0.0066 U	0.0163 U	0.0161 U	0.0063 U	0.0062 U	0.0066 U	0.0167 U	0.016 U
PESTICIDES																		
4,4'-DDT	0.000011	√	1.1	0.001	--	√	--	√	0.005 UJ	0.0054 U	0.0053 U	0.0101 U	0.00989 U	0.005 U	0.0054 U	0.0054 U	0.0087 U	0.00989 U
alpha-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0026 UJ	0.0028 U	0.0028 U	0.0101 U	0.00989 U	0.0026 U	0.0029 U	0.0066 J	0.0087 U	0.00989 U
gamma-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0027 UJ	0.0029 U	0.0029 U	0.0101 U	0.00989 U	0.0027 U	0.003 U	0.0029 U	0.0087 U	0.00989 U

TABLE 7-15
Groundwater Ecological Screening Evaluation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L) MW37 10/13/2007	MW37 5/21/2008	MW37 10/5/2008	MW37 6/1/2009	MW37 9/20/2009	MW38 10/13/2007	MW38 5/16/2008	MW38 10/7/2008	MW38 6/2/2009	MW38 9/21/2009
EXPLOSIVES																		
1,3,5-Trinitrobenzene	270	--	--	--	--	--	--	--	0.017 U	0.039 J	0.017 UJ	0.016 U	0.016 U	0.017 UJ	0.017 U	0.017 U	0.017 U	0.018 U
RDX	--	--	--	--	--	--	--	--	0.021 U	0.021 U	0.021 UJ	0.02 U	0.02 U	0.021 UJ	0.021 U	0.021 U	0.02 U	0.021 U
METALS																		
Aluminum	75	√	750	87	--	√	7,538	--	98.8 J	35 U	35 U	62 U	150 U	35 U	35 U	35 U	62 U	150 U
Antimony	30	--	--	--	--	--	--	--	2 U	2 U	2 U	0.31 U	0.31 U	2 U	2 U	2 U	0.31 U	0.31 U
Arsenic	55	--	340	150	--	--	36	--	1 U	1 U	1 U	1.5 U	1.5 U	3.4	8.5	2.7 J	7.47	7.1
Barium	3.9	√	--	--	--	--	551	--	108	106	113	114	99.7	153	164	162	178	148
Boron	1.6	√	--	--	--	--	--	√	31.8 J	10 U	10 U	71.2 J	62 U	32.8 J	10 U	10 U	62 U	62 U
Calcium	116,000	√	--	--	--	--	--	√	77,100	66,500	75,000	72,300	70,900	81,800	84,100	103,000	91,500	85,700
Cobalt	3.0	√	--	--	--	--	--	√	1 U	1 U	1 U	0.31 U	0.31 U	2.9 J	1 U	1.6 J	0.846 J	0.505 J
Copper	0.205	√	13	9.0	--	√	--	√	2.6 J	2.6 J	2.4 J	3.1 U	2.08 J	1 U	1 U	1 J	3.1 U	1.8 U
Iron	16	√	--	1000	--	√	16,938	--	209	16 U	16 U	62 U	310 U	1,880	7,490	2,120	7,360	5,520
Lead	1		--	--	--	--	34.07	--	0.6 U	0.6 U	0.6 U	0.31 U	0.31 U	0.6 U	0.6 U	0.6 U	0.31 U	0.348 J
Magnesium	82,000	√	--	--	--	--	--	√	16,600	16,100	17,300	17,700	17,100	15,800	17,900	20,100	20,300	17,800
Manganese	80	√	--	--	--	--	3,875	--	121	197	65	103 J+	77	1,020	905	842	949	748
Nickel	5.0	√	470	52	--	√	--	√	3.3	2.6 J	1.4 J	3.42	2.48	2.9 J	1 U	1.7 J	2.07	2.12
Potassium	530,000	--	--	--	--	--	--	--	4,870	4,320	4,770	4,650	4,490	5,360	5,370	6,000	5,630	5,430
Selenium	1.0	√	12.8	5.0	√	√	--	√	2.5 J	1 U	1 U	0.965 J	0.62 U	1 U	1 U	1 U	1.13 J	0.62 U
Sodium	680,000	--	--	--	--	--	--	--	4,940	5,290	5,330	6,340	5,760	5,030	6,320 J	5,790	6,410	5,980
Thallium	0.8	--	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	0.78 U	0.78 U	0.5 U	0.5 U	0.5 U	0.78 U	0.78 U
Vanadium	19	--	--	--	--	--	--	--	4 U	4 U	4 U	6.2 U	6.2 U	4 U	4 U	4 U	6.2 U	6.2 U
Zinc	21	--	120	120	--	--	--	--	4 U	4 U	4 U	6.2 U	7.8 U	4 U	6.3 J	4 U	6.2 U	7.8 U
PAH																		
2-Methylnaphthalene	--	--	--	--	--	--	--	--	0.0029 U	0.0057 U	0.0058 UJ	0.015 U	0.0156 U	0.003 UJ	0.0059 U	0.0058 UJ	0.0161 U	0.015 U
Acenaphthene	5.8	--	--	--	--	--	--	--	0.0033 U	0.0033 U	0.0033 UJ	0.015 U	0.0156 U	0.0035 UJ	0.0034 U	0.0033 UJ	0.0161 U	0.015 U
Acenaphthylene	--	--	--	--	--	--	--	--	0.0032 U	0.0034 J	0.0032 UJ	0.015 U	0.0156 U	0.0034 UJ	0.0033 U	0.0032 UJ	0.0161 U	0.015 U
Fluorene	3	--	--	--	--	--	--	--	0.0042 U	0.0042 U	0.0042 UJ	0.015 U	0.0156 U	0.0044 UJ	0.0044 U	0.0042 UJ	0.0161 U	0.015 U
Naphthalene	1.1	√	--	--	--	--	--	√	0.0014 J	0.0038 U	0.0046 J-	0.031 U	0.0323 U	0.0014 J-	0.004 U	0.0039 UJ	0.0333 U	0.031 U
Phenanthrene	0.4	--	--	--	--	--	--	--	0.0066 U	0.0066 U	0.0066 UJ	0.015 U	0.0156 U	0.007 UJ	0.0068 U	0.0066 UJ	0.0161 U	0.0303 J
PESTICIDES																		
4,4'-DDT	0.000011	√	1.1	0.001	--	√	--	√	0.0052 U	0.0054 U	0.0052 UJ	0.01 U	0.0101 U	0.013 J	0.005 U	0.0052 U	0.0101 U	0.00969 U
alpha-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0028 U	0.0028 U	0.0028 UJ	0.01 U	0.0101 U	0.0027 UJ	0.0027 U	0.0028 U	0.0101 U	0.00969 U
gamma-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0029 U	0.0029 U	0.0029 UJ	0.01 U	0.0101 U	0.0028 UJ	0.0028 U	0.0029 U	0.0101 U	0.00969 U

TABLE 7-15

Groundwater Ecological Screening Evaluation

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L)											
									MW40					MW41	MW77			MW82	MW83	MW84
									10/15/2007	5/18/2008	10/4/2008	5/26/2009	9/19/2009	10/14/2007	10/5/2008	6/2/2009	9/20/2009	11/7/2009	11/7/2009	11/7/2009
EXPLOSIVES																				
1,3,5-Trinitrobenzene	270	--	--	--	--	--	--	--	0.017 U	0.017 U	0.017 U	0.016 U	0.017 U	0.017 UJ	0.017 UJ	0.017 U	0.016 U	--	--	--
RDX	--	--	--	--	--	--	--	--	0.021 U	0.021 U	0.021 U	0.02 U	0.02 U	0.021 UJ	0.064 J-	0.02 U	0.02 U	--	--	--
METALS																				
Aluminum	75	√	750	87	--	√	7,538	--	35 U	35 U	35 U	62 U	150 U	41.3 J	39 J	62 U	150 U	--	--	--
Antimony	30	--	--	--	--	--	--	--	2 U	2 U	2 U	0.31 U	0.31 U	2 U	2 U	1.31	0.31 U	--	--	--
Arsenic	55	--	340	150	--	--	36	--	3.6	15.3	16.9	15.6	10.3	10.4	2.6 J	1.5 U	1.5 U	--	--	--
Barium	3.9	√	--	--	--	--	551	--	239	255	257	253	197	167	159	149	101	--	--	--
Boron	1.6	√	--	--	--	--	--	√	10 U	10 U	10 U	62 U	62 U	47.9 J	10 U	62 U	62 U	--	--	--
Calcium	116,000	√	--	--	--	--	--	√	61,500	60,800	60,200	65,100	50,000	94,700	137,000	208,000	147,000	--	--	--
Cobalt	3.0	√	--	--	--	--	--	√	1 U	1 U	1 U	0.31 U	0.31 U	2 J	3.8	2.4	1.47	--	--	--
Copper	0.205	√	13	9.0	--	√	--	√	1 U	1 U	1 U	3.1 U	1.8 U	1 U	9.6	3.1 U	1.8 U	--	--	--
Iron	16	√	--	1000	--	√	16,938	--	6,720	6,610	7,030	6,810	5,860	1,480	987	62 U	310 U	--	--	--
Lead	1		--	--	--	--	34.07	--	0.6 U	0.6 U	0.6 U	0.31 U	0.31 U	0.6 U	0.6 U	0.31 U	0.31 U	--	--	--
Magnesium	82,000	√	--	--	--	--	--	√	14,200	13,700	13,000	14,300	11,600	25,900	55,100	85,800	56,900	--	--	--
Manganese	80	√	--	--	--	--	3,875	--	610	620	550	628	509	505	1,650	1,940	1,360	--	--	--
Nickel	5.0	√	470	52	--	√	--	√	1 U	1 U	1 U	0.972 J	0.644 J	1.7 J	3.5	12	7.23	--	--	--
Potassium	530,000	--	--	--	--	--	--	--	5,970	6,010	5,610	5,920	4,940	7,430	8,690	9,710	8,310	--	--	--
Selenium	1.0	√	12.8	5.0	√	√	--	√	1 U	1 U	1 U	2.46	0.62 U	1.8 J	1 U	0.62 U	0.62 U	--	--	--
Sodium	680,000	--	--	--	--	--	--	--	11,100	11,700	10,800	11,900	9,400	5,860	8,560	10,000	7,900	--	--	--
Thallium	0.8	--	--	--	--	--	--	--	0.5 U	0.5 U	0.5 U	0.78 U	0.78 U	0.5 U	0.5 U	0.78 U	0.78 U	--	--	--
Vanadium	19	--	--	--	--	--	--	--	4 U	4 U	4 U	6.2 U	6.2 U	4 U	4 U	6.2 U	6.2 U	--	--	--
Zinc	21	--	120	120	--	--	--	--	4 U	8.6 J	6.4 J	13.2 J	7.8 U	4 U	4.6 J	6.2 U	7.8 U	--	--	--
PAH																				
2-Methylnaphthalene	--	--	--	--	--	--	--	--	0.0028 U	0.0056 U	0.0059 U	0.016 U	0.016 U	0.0028 UJ	5.9 J-	0.0172 U	0.0221 J	--	--	--
Acenaphthene	5.8	--	--	--	--	--	--	--	0.0032 U	0.0032 U	0.0034 U	0.016 U	0.016 U	0.0032 UJ	0.2 J-	0.0193 J	0.0461 J	--	--	--
Acenaphthylene	--	--	--	--	--	--	--	--	0.0031 U	0.0031 U	0.0033 U	0.016 U	0.016 U	0.0031 UJ	0.094 J-	0.0172 U	0.0159 U	--	--	--
Fluorene	3	--	--	--	--	--	--	--	0.0041 U	0.0041 U	0.0044 U	0.016 U	0.016 U	0.0041 UJ	0.42 J-	0.0333 J	0.0747	--	--	--
Naphthalene	1.1	√	--	--	--	--	--	√	0.0015 J	0.0038 U	0.004 U	0.033 U	0.033 U	0.0013 UJ	8.8 J-	0.0356 U	0.2	0.62 U	0.62 U	0.62 U
Phenanthrene	0.4	--	--	--	--	--	--	--	0.0064 U	0.0064 U	0.0068 U	0.016 U	0.016 U	0.0064 UJ	0.2 J-	0.0172 U	0.0159 U	--	--	--
PESTICIDES																				
4,4'-DDT	0.000011	√	1.1	0.001	--	√	--	√	0.005 U	0.0052 U	0.0053 U	0.0108 U	0.01 U	0.0052 UJ	0.0053 UJ	0.0106 U	0.0094 U	--	--	--
alpha-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0027 U	0.0027 U	0.0028 U	0.0108 U	0.01 U	0.0027 UJ	0.0028 UJ	0.0106 U	0.0094 U	--	--	--
gamma-Chlordane	0.0043	√	2.4	0.0043	--	√	--	√	0.0028 U	0.0028 U	0.0029 U	0.0108 U	0.01 U	0.0028 UJ	0.0093 J	0.0106 U	0.0094 U	--	--	--

TABLE 7-15

Groundwater Ecological Screening Evaluation

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Overall Maximum Detect (ug/L)	2007 Maximum Detect (ug/L)	2008 Maximum Detect (ug/L)	2009 Maximum Detect (ug/L)
SVOC												
Di-n-butyl phthalate	3	--	--	--	--	--	--	--	1.3	ND	1.3	ND
TPH												
TPH-Diesel	--	--	--	--	--	--	--	--	2,700	130	2,700	1,100
TPH-Gasoline	--	--	--	--	--	--	--	--	130	ND	130	ND
TPH-Motor Oil	--	--	--	--	--	--	--	--	322	130	150	322
VOC												
1,1,2,2-Tetrachloroethane	240	--	--	--	--	--	--	--	0.25	ND	ND	0.25
1,2,3-Trichloropropane	--	--	--	--	--	--	--	--	0.019	ND	ND	0.019
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	6.3	ND	6.3	ND
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--	--	0.19	ND	0.19	ND
4-Isopropyltoluene	--	--	--	--	--	--	--	--	1.1	ND	1.1	ND
Acetone	1,500	--	--	--	--	--	--	--	1.2	1.2	1.1	ND
Chloroform	0.0018	--	--		--	--	--	--	0.64	ND	ND	0.64
Chloromethane	--	--	--	--	--	--	--	--	0.8	0.28	ND	0.8
cis-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.46	ND	0.46	0.38
Ethylbenzene	7.3	--	--	--	--	--	--	--	1.6	ND	1.6	ND
Isopropylbenzene	--	--	--	--	--	--	--	--	0.93	ND	0.93	0.93
m,p-Xylene	13	--	--	--	--	--	--	--	1.8	ND	1.8	ND
n-Butylbenzene	--	--	--	--	--	--	--	--	0.89	ND	0.89	ND
n-Propylbenzene	--	--	--	--	--	--	--	--	1.2	ND	1.2	ND
o-Xylene	--	--	--	--	--	--	--	--	0.34	ND	0.34	ND
sec-Butylbenzene	--	--	--	--	--	--	--	--	0.83	ND	0.83	ND
tert-Butylbenzene	--	--	--	--	--	--	--	--	0.29	ND	0.29	ND
Toluene	2.0	√	--	--	--	--	--	√	2.9	ND	2.9	ND
trans-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.18	ND	0.18	ND
Trichloroethene (TCE)	47	--	--	--	--	--	--	--	1.81	ND	1.81	1.28
Vinyl chloride	1.3	--	--	--	--	--	--	--	0.13	ND	0.035	0.13

Notes:

a) Background data for arsenic, barium, and lead were obtained from upper confidence intervals for metals in Ft. Wainwright background groundwater (U.S. Army, 1994); background levels others were obtained from Eielson Air Force Base, Alaska (EPA, 2004a).

ND = not detected

-- = not available

TABLE 7-15

Groundwater Ecological Screening Evaluation

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L) MW35 10/16/2007	MW35 5/21/2008	MW35 10/5/2008	MW35 6/1/2009	MW35 9/20/2009	MW36 10/15/2007	MW36 5/17/2008	MW36 10/5/2008	MW36 6/1/2009	MW36 9/20/2009
SVOC																		
Di-n-butyl phthalate	3	--	--	--	--	--	--	--	0.64 UJ	1.2 U	1.1 U	3.37 U	3.1 U	0.65 U	1.3 J	1.2 U	3.41 U	3.26 U
TPH																		
TPH-Diesel	--	--	--	--	--	--	--	--	62 J+	62 J-	44 J	250 UJ	240 U	50 J	31 J	26 J	250 UJ	245 U
TPH-Gasoline	--	--	--	--	--	--	--	--	17 UJ	10 U	10 U	31 U	31 U	10 U	10 U	10 U	31 U	31 U
TPH-Motor Oil	--	--	--	--	--	--	--	--	110 J+	98 U	95 U	150 UJ	144 U	95 J	92 U	110 J	150 UJ	147 U
VOC																		
1,1,2,2-Tetrachloroethane	240	--	--	--	--	--	--	--	0.11 UJ	0.008 U	0.008 U	0.15 U	0.008 U	0.37 U	0.008 U	0.008 U	0.15 U	0.008 U
1,2,3-Trichloropropane	--	--	--	--	--	--	--	--	0.11 UJ	0.014 U	0.014 U	0.31 U	0.014 U	0.3 U	0.014 U	0.014 U	0.31 U	0.014 U
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	0.086 UJ	0.12 U	0.12 U	0.31 U	0.31 U	0.12 U	0.12 UJ	0.12 UJ	0.31 U	0.31 U
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--	--	0.077 UJ	0.14 U	0.14 U	0.31 U	0.31 U	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U
4-Isopropyltoluene	--	--	--	--	--	--	--	--	0.077 UJ	0.13 U	0.13 U	0.31 U	0.31 U	0.13 U	0.13 U	0.13 UJ	0.31 U	0.31 U
Acetone	1,500	--	--	--	--	--	--	--	1.1 U	1.1 J	1 UJ	3.1 U	3.1 U	1 U	1 U	1 UJ	3.1 U	3.1 U
Chloroform	0.0018	--	--		--	--	--	--	0.067 UJ	0.12 U	0.12 U	0.3 U	0.3 U	0.12 U	0.12 U	0.12 UJ	0.3 U	0.3 U
Chloromethane	--	--	--	--	--	--	--	--	0.18 U	0.25 U	0.25 U	0.31 U	0.31 U	0.25 U	0.25 U	0.25 UJ	0.31 U	0.8 J+
cis-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.079 UJ	0.1 U	0.1 U	0.31 U	0.31 U	0.1 U	0.1 U	0.1 UJ	0.31 U	0.31 U
Ethylbenzene	7.3	--	--	--	--	--	--	--	0.085 UJ	0.1 U	0.21 J	0.31 U	0.31 U	0.27 U	0.1 U	0.1 UJ	0.31 U	0.31 U
Isopropylbenzene	--	--	--	--	--	--	--	--	0.084 UJ	0.12 U	0.12 U	0.31 U	0.31 U	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U
m,p-Xylene	13	--	--	--	--	--	--	--	0.17 UJ	0.18 U	0.91 J	0.62 U	0.62 U	0.18 U	0.18 UJ	0.22 J-	0.62 U	0.62 U
n-Butylbenzene	--	--	--	--	--	--	--	--	0.098 UJ	0.12 U	0.12 U	0.31 U	0.31 U	0.12 U	0.12 UJ	0.12 UJ	0.31 U	0.31 U
n-Propylbenzene	--	--	--	--	--	--	--	--	0.069 UJ	0.15 U	0.15 U	0.31 U	0.31 U	0.15 U	0.15 UJ	0.15 UJ	0.31 U	0.31 U
o-Xylene	--	--	--	--	--	--	--	--	0.068 UJ	0.1 U	0.34 J	0.31 U	0.31 U	0.1 U	0.1 U	0.1 UJ	0.31 U	0.31 U
sec-Butylbenzene	--	--	--	--	--	--	--	--	0.04 UJ	0.12 U	0.12 U	0.31 U	0.31 U	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U
tert-Butylbenzene	--	--	--	--	--	--	--	--	0.048 UJ	0.14 U	0.14 U	0.31 U	0.31 U	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U
Toluene	2.0	√	--	--	--	--	--	√	0.066 UJ	0.25 U	0.57 J	0.31 U	0.31 U	0.25 U	0.25 U	0.25 UJ	0.31 U	0.31 U
trans-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.074 UJ	0.11 U	0.11 U	0.31 U	0.31 U	0.11 U	0.11 U	0.11 UJ	0.31 U	0.31 U
Trichloroethene (TCE)	47	--	--	--	--	--	--	--	0.074 UJ	0.014 U	0.014 U	0.31 U	0.014 U	0.31 U	0.014 U	0.014 U	0.31 U	0.015 J
Vinyl chloride	1.3	--	--	--	--	--	--	--	0.18 UJ	0.0097 U	0.0097 U	0.31 U	0.013 J	0.12 U	0.0097 U	0.0097 U	0.31 U	0.0097 U

Notes:

a) Background data for arsenic, barium, and lead were obtained from upper confidence intervals for metals in Ft. Wainwright background groundwater (U.S. Army, 1994); background levels others were obtained from Eielson Air Force Base, Alaska (EPA, 2004a).

ND = not detected

-- = not available

TABLE 7-15

Groundwater Ecological Screening Evaluation

Remedial Investigation Report

Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L)									
									MW37					MW38				
									10/13/2007	5/21/2008	10/5/2008	6/1/2009	9/20/2009	10/13/2007	5/16/2008	10/7/2008	6/2/2009	9/21/2009
SVOC																		
Di-n-butyl phthalate	3	--	--	--	--	--	--	--	0.66 U	1.2 U	1.2 UJ	3.3 U	3.1 U	0.66 UJ	1.2 U	1.2 UJ	67.4 U	3.23 U
TPH																		
TPH-Diesel	--	--	--	--	--	--	--	--	130	360 J-	90	350 J-	240 U	99 J-	31 J	75	250 U	240 UJ
TPH-Gasoline	--	--	--	--	--	--	--	--	10 U	10 U	10 U	31 U	31 U	10 UJ	28 J	10 U	31 U	31 U
TPH-Motor Oil	--	--	--	--	--	--	--	--	120 J	99 J	99 U	144 UJ	144 U	120 J-	98 U	97 U	150 U	144 UJ
VOC																		
1,1,2,2-Tetrachloroethane	240	--	--	--	--	--	--	--	0.37 U	0.008 U	0.008 U	0.15 U	0.008 U	0.37 UJ	0.008 U	0.008 U	0.15 U	0.008 U
1,2,3-Trichloropropane	--	--	--	--	--	--	--	--	0.3 U	0.014 U	0.014 U	0.31 U	0.014 U	0.3 UJ	0.014 U	0.014 U	0.31 U	0.014 U
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.12 U	0.12 UJ	0.31 U	0.31 U
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--	--	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U	0.14 UJ	0.14 U	0.14 UJ	0.31 U	0.31 U
4-Isopropyltoluene	--	--	--	--	--	--	--	--	0.13 U	0.13 U	0.13 UJ	0.31 U	0.31 U	0.13 UJ	0.13 U	0.13 UJ	0.31 U	0.31 U
Acetone	1,500	--	--	--	--	--	--	--	1 U	1 U	1 UJ	3.1 U	3.1 U	1 U	1 U	1 UJ	3.1 U	3.1 U
Chloroform	0.0018	--	--		--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.3 U	0.3 U	0.12 UJ	0.12 U	0.12 UJ	0.3 U	0.3 U
Chloromethane	--	--	--	--	--	--	--	--	0.25 U	0.25 U	0.25 UJ	0.31 U	0.31 U	0.28 J-	0.25 U	0.25 UJ	0.31 U	0.31 U
cis-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.1 U	0.1 U	0.1 UJ	0.31 U	0.31 U	0.1 U	0.1 U	0.16 J-	0.31 U	0.31 U
Ethylbenzene	7.3	--	--	--	--	--	--	--	0.27 U	0.1 U	0.18 J-	0.31 U	0.31 U	0.27 UJ	0.1 U	0.1 UJ	0.31 U	0.31 U
Isopropylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.12 U	0.12 UJ	0.31 U	0.31 U
m,p-Xylene	13	--	--	--	--	--	--	--	0.18 U	0.18 U	0.87 J-	0.62 U	0.62 U	0.18 UJ	0.18 UJ	0.18 UJ	0.62 U	0.62 U
n-Butylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.12 U	0.12 UJ	0.31 U	0.31 U
n-Propylbenzene	--	--	--	--	--	--	--	--	0.15 U	0.15 U	0.15 UJ	0.31 U	0.31 U	0.15 UJ	0.15 U	0.15 UJ	0.31 U	0.31 U
o-Xylene	--	--	--	--	--	--	--	--	0.1 U	0.1 U	0.3 J-	0.31 U	0.31 U	0.1 UJ	0.1 U	0.1 UJ	0.31 U	0.31 U
sec-Butylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.12 U	0.12 UJ	0.31 U	0.31 U
tert-Butylbenzene	--	--	--	--	--	--	--	--	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U	0.14 UJ	0.14 U	0.14 UJ	0.31 U	0.31 U
Toluene	2.0	√	--	--	--	--	--	√	0.25 U	0.25 U	0.54 J-	0.31 U	0.31 U	0.25 UJ	0.25 U	0.25 UJ	0.31 U	0.31 U
trans-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.11 U	0.11 U	0.11 UJ	0.31 U	0.31 U	0.11 UJ	0.11 U	0.11 UJ	0.31 U	0.31 U
Trichloroethene (TCE)	47	--	--	--	--	--	--	--	0.31 U	0.014 U	0.014 U	0.31 U	0.014 U	0.31 UJ	0.22	0.17 J-	0.53 J	0.21
Vinyl chloride	1.3	--	--	--	--	--	--	--	0.12 U	0.0097 U	0.0097 U	0.31 U	0.015 J+	0.12 UJ	0.012 J	0.0097 U	0.31 U	0.0097 U

Notes:

a) Background data for arsenic, barium, and lead were obtained from upper confidence intervals for metals in Ft. Wainwright background groundwater (U.S. Army, 1994); background levels others were obtained from Eielson Air Force Base, Alaska (EPA, 2004a).

ND = not detected

-- = not available

TABLE 7-15
Groundwater Ecological Screening Evaluation
Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

Chemical	ADEC Freshwater ERBSC (ug/L)	ADEC Scoping Identified as COPEC	Freshwater Acute WQC (ug/L)	Freshwater Chronic WQC (ug/L)	Exceeds Acute WQC	Exceeds Chronic WQC	Background Concentration[a] (ug/L)	Maximum Exceeds Screening Value and Background	Groundwater Samples (ug/L)											
									MW40					MW41	MW77			MW82	MW83	MW84
									10/15/2007	5/18/2008	10/4/2008	5/26/2009	9/19/2009	10/14/2007	10/5/2008	6/2/2009	9/20/2009	11/7/2009	11/7/2009	11/7/2009
SVOC																				
Di-n-butyl phthalate	3	--	--	--	--	--	--	--	0.64 U	1.2 J	1.1 U	3.23 U	3.33 U	0.66 UJ	1.1 UJ	3.37 U	3.37 U	--	--	--
TPH																				
TPH-Diesel	--	--	--	--	--	--	--	--	60	32 J	30 J	245 U	250 U	51 J-	2700 J+	1100	271 J	260 U	260 U	269 U
TPH-Gasoline	--	--	--	--	--	--	--	--	10 U	10 U	10 U	31 U	31 U	10 UJ	130	31 U	31 U	--	--	--
TPH-Motor Oil	--	--	--	--	--	--	--	--	270 J	95 U	150 J	147 U	150 U	130 J-	560 U	322 J	144 U	--	--	--
VOC																				
1,1,2,2-Tetrachloroethane	240	--	--	--	--	--	--	--	0.37 U	0.008 U	0.008 U	0.008 U	0.008 U	0.37 UJ	0.008 U	0.15 U	0.25 J	0.008 U	0.008 U	0.008 U
1,2,3-Trichloropropane	--	--	--	--	--	--	--	--	0.3 U	0.014 U	0.014 U	0.014 U	0.019 J+	0.3 UJ	0.014 U	0.31 U	0.014 U	0.014 U	0.014 U	0.014 U
1,2,4-Trimethylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	6.3 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
1,3,5-Trimethylbenzene	--	--	--	--	--	--	--	--	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U	0.14 UJ	0.19 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
4-Isopropyltoluene	--	--	--	--	--	--	--	--	0.13 U	0.13 U	0.13 UJ	0.31 U	0.31 U	0.13 UJ	1.1 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Acetone	1,500	--	--	--	--	--	--	--	1.2 J	1 UJ	1 UJ	3.1 U	3.1 U	1 J-	1 UJ	3.1 U	3.1 U	0.31 U	0.31 U	0.31 U
Chloroform	0.0018	--	--		--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.3 U	0.3 U	0.12 UJ	0.12 UJ	0.3 U	0.3 U	0.3 J	0.64 J	0.3 U
Chloromethane	--	--	--	--	--	--	--	--	0.25 U	0.25 U	0.25 UJ	0.31 U	0.31 U	0.25 UJ	0.25 UJ	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
cis-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.1 U	0.1 U	0.1 UJ	0.31 U	0.31 U	0.1 UJ	0.46 J-	0.38 J	0.31 U	0.31 U	0.31 U	0.31 U
Ethylbenzene	7.3	--	--	--	--	--	--	--	0.27 U	0.1 U	0.1 UJ	0.31 U	0.31 U	0.27 UJ	1.6 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Isopropylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.93 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
m,p-Xylene	13	--	--	--	--	--	--	--	0.18 U	0.18 UJ	0.18 UJ	0.62 U	0.62 U	0.18 UJ	1.8 J-	0.62 U	0.62 U	0.31 U	0.31 U	0.31 U
n-Butylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.89 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
n-Propylbenzene	--	--	--	--	--	--	--	--	0.15 U	0.15 U	0.15 UJ	0.31 U	0.31 U	0.15 UJ	1.2 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
o-Xylene	--	--	--	--	--	--	--	--	0.1 U	0.1 U	0.1 UJ	0.31 U	0.31 U	0.1 UJ	0.21 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
sec-Butylbenzene	--	--	--	--	--	--	--	--	0.12 U	0.12 U	0.12 UJ	0.31 U	0.31 U	0.12 UJ	0.83 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
tert-Butylbenzene	--	--	--	--	--	--	--	--	0.14 U	0.14 U	0.14 UJ	0.31 U	0.31 U	0.14 UJ	0.29 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Toluene	2.0	√	--	--	--	--	--	√	0.25 U	0.25 U	0.25 UJ	0.31 U	0.31 U	0.25 UJ	2.9 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
trans-1,2-Dichloroethene	590	--	--	--	--	--	--	--	0.11 U	0.11 U	0.11 UJ	0.31 U	0.31 U	0.11 UJ	0.18 J-	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
Trichloroethene (TCE)	47	--	--	--	--	--	--	--	0.31 U	0.044 J	0.04 J	0.026 J	0.048 J+	0.31 UJ	1.3 J-	1.81	1.28	0.014 U	0.014 U	0.014 U
Vinyl chloride	1.3	--	--	--	--	--	--	--	0.12 U	0.019 J	0.035 J	0.053 J	0.13 J+	0.12 UJ	0.0097 U	0.31 U	0.0097 U	0.033 J+	0.0097 U	0.0097 U

Notes:

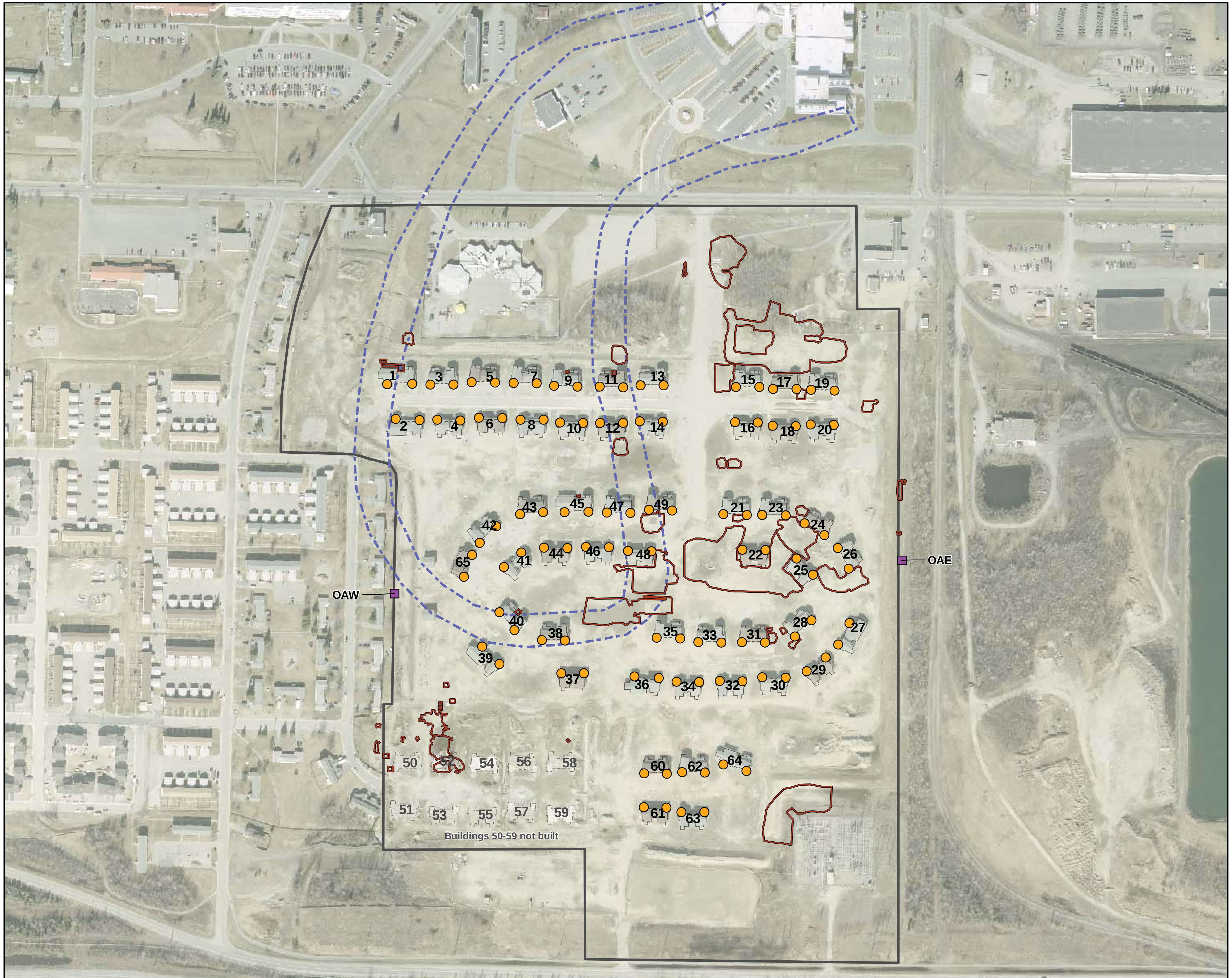
a) Background data for arsenic, barium, and lead were obtained from upper confidence intervals for metals in Ft. Wainwright background groundwater (U.S. Army, 1994); background levels others were obtained from Eielson Air Force Base, Alaska (EPA, 2004a).

ND = not detected

-- = not available

TABLE 7-16
Home Range Information for Representative Wildlife

Wildlife	Description
Northern harrier	Several home range/territory area studies on northern harriers have been summarized by the California Department of Fish and Game and estimate their home range to be between 40 and 2,200 acres (1990). An extensive study of feeding territories among birds indicated that the mean feeding territory for northern harriers is 623 acres (Schoener, 1968).
American kestrel	Literature estimates of the American kestrel home range are from 52 to 1,235 acres (USEPA, 1993).
Mallard	Literature estimates of the mallard home range are from 98 to >3,000 acres (USEPA, 1993).
Red Fox	Literature estimates of the red fox home range are from 680 to 8,450 acres (USEPA, 1993).
Mink	Literature estimates of the mink home range are from 19 to 1,900 acres (USEPA, 1993).
Snowshoe hare	Mean home range of 14.5 acres; no significant difference in home range sizes between males and females (Jstor, 2008).



LEGEND

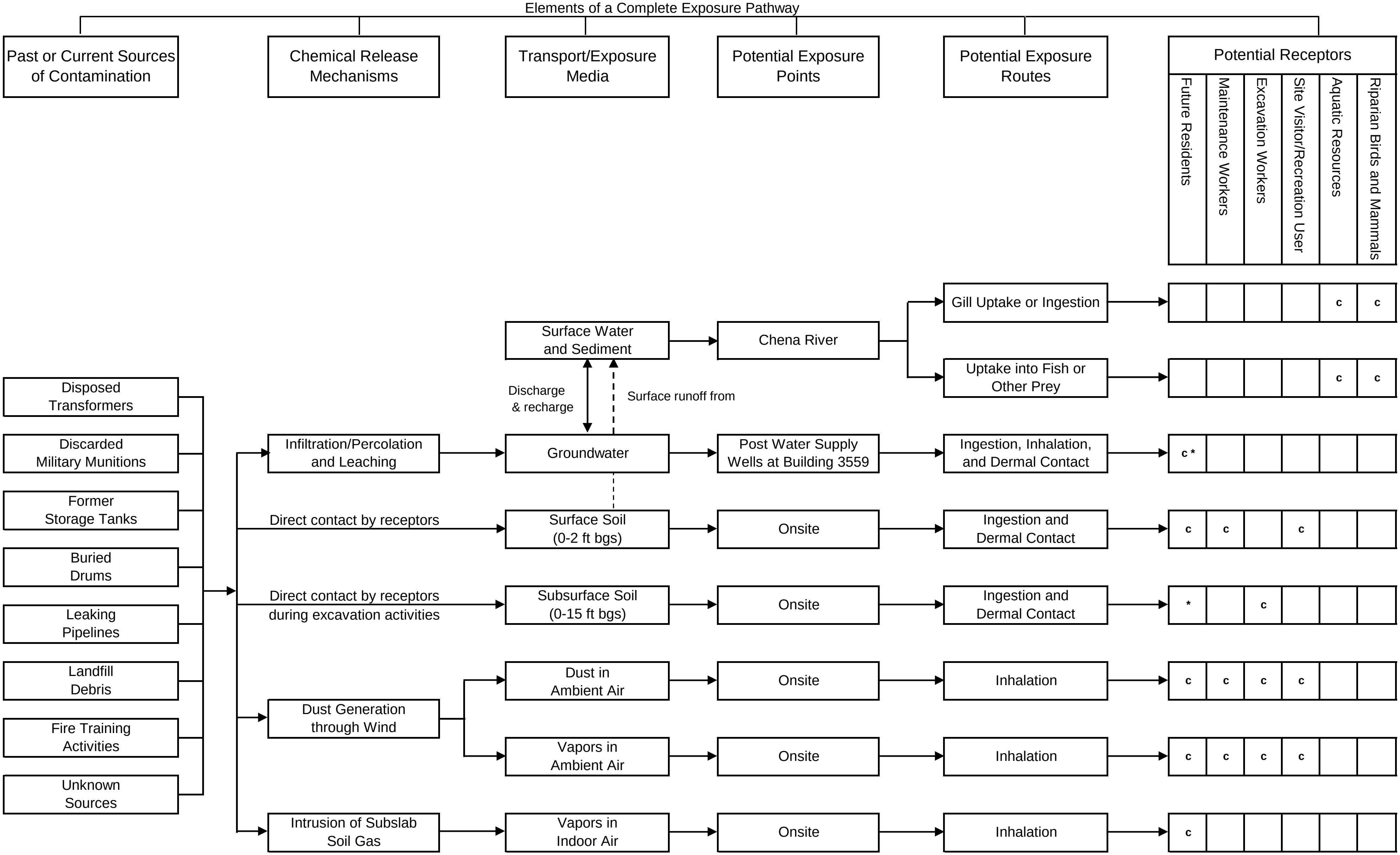
- Site Boundary
- Former Hoppe's Slough
- Excavation Boundary
- Sub-slab Sample Location
- Ambient Air Sample Location

0 275
Feet

N

FIGURE 7-1
Subslab Soil Gas and Ambient Air Sample Locations
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska

FIGURE 7-2
Conceptual Site Model for Potential Human and Ecological Exposures
Final Remedial Investigation Report
Former Communications Site, Fort Wainwright, Alaska



Notes:
c = Potentially complete pathway (addressed quantitatively)
Blank = incomplete pathway
* = Soil from 0-15 ft bgs and groundwater from wellpoints outside the potential capture zone of the Post Supply well were evaluated under the hypothetical unrestricted use exposure scenario.

SECTION 8

Conclusions

The overall goals of the RI have been accomplished: sufficient data have been collected from all media of interest in the FCS to characterize the nature and extent of contamination, evaluate potential hazards from munitions-related items, and assess potential risks to human and ecological receptors. This section presents key RI conclusions.

8.1 Sample Coverage

Significant numbers of soil, groundwater, soil-gas, and other media samples have been collected at the FCS since construction of the Taku Gardens family housing development began. Pre-RI sampling targeted particular portions of the FCS and limited types of chemicals; whereas, the RI was more broadly focused on identifying and characterizing sources, determining nature and extent of contamination, and assessing potential risks posed by a variety of chemicals and exposure pathways. FCS soil sampling strategies have been both judgmental and systematic across the site. Judgmental samples were collected, for example, as confirmation samples at targeted drum and debris removal areas where geophysical anomalies were observed and at known or suspected hot spot areas. Systematic sampling was also conducted specifically to gain even coverage (e.g., the 87 supplemental surface soil samples collected during the RI in 2008 and 2009) and to improve the areal and multi-chemical representation across the site, allowing for more comprehensive assessment of potential human health risks. Subslab soil-gas sampling included complete coverage of all 110 residential living units. Because the systematic sampling for these media was roughly evenly spaced with high spatial density across the FCS, the samples provided exceptional coverage for assessing historical and current conditions at the FCS. More importantly, the data for selected pre-RI samples and RI samples provided sufficient, suitably located data of appropriate quality to characterize current conditions at the FCS relative to the nature and extent of contamination remaining at the FCS and the potential risks associated with exposure to the contaminants.

8.2 Contaminant Source Characterization and Removal

A variety of buried metal and debris, including empty drums, some drums with contents, and munitions-related items were found in the subsurface at the FCS. It must be noted that although munitions-related items were found in various places across the site, DMM were only found in the former Subarea A. In fact, the only verified DMM found on site were two 3.5-inch training rounds with normal propellant charges in the rocket motors but without warheads. The buried debris, along with associated contaminated soil, tended to be concentrated in former low-lying areas (e.g., the former channel of Hoppe's Slough) and in pits that were filled and covered before the FCS was developed. These source areas appear to be related to historical uses of the area for salvage, troop billets, and offices. Materials and chemicals placed in these former disposal areas are assumed to be the primary sources of contaminated soil and groundwater at the FCS.

Approximately 1,058 drums (1,050 of which were either empty or crushed with no discernible residue) and approximately 5,000 yd^3 of debris, munitions-related items, and contaminated soil were removed from the surface and subsurface at the FCS during 2007, 2008, and 2009 investigation activities. Similar metal debris and soil were also removed during the course of site clearing and grubbing in 2004 and housing construction activities in 2005. Although some debris may remain beneath buildings, most potential contaminant source materials have been removed from the FCS. Some residual metal debris has been observed beneath Buildings, 15, 17, 22, 24, and 48. Based on geophysical survey information, observations during the building foundation construction, and results of this investigation, six other buildings may have been constructed over residual debris (Table 4-9 and Figure 4-3). However, as evidenced by the predominantly empty and crushed drums and limited volume of contaminated soil recovered from beneath Building 49 in 2009, the presence of buried metal and drums does not directly correlate with chemical contamination. In addition, numerous test pits and exploratory excavations at the FCS encountered buried metal, but soil and groundwater contamination primarily coincided only with extensive and concentrated deposits of materials in the former Subarea A.

8.3 Nature and Extent of Residual Contamination

Soil, groundwater, and soil-gas have been thoroughly sampled and sufficient data of appropriate quality exist to characterize the nature and extent of contamination remaining at the FCS.

Soil contamination at the FCS is limited to three localized subsurface soil hot spots (samples where the concentration of a COI exceeds the actual ADEC Method 2 cleanup level) beneath and around portions of the FCS where contaminated soil and debris were removed during pre-RI or RI field activities. These subsurface hot spots consist of two DRO exceedances in the vicinity of Buildings 7 and 8 at depths of 12 and 16 feet and one 1,2,3-trichloropropane exceedance at a depth of 4 feet between Buildings 22 and 24. No hot spots were identified in surface soil.

The occurrence of contaminated groundwater is also consistent with the locations and types of contaminant sources found and removed at the FCS. Petroleum hydrocarbons, chlorinated solvents and their breakdown products, 1,2,3-trichloropropane, and several other analytes were detected in groundwater at the FCS at concentrations exceeding PSLs; however, the lateral and vertical extents of the affected groundwater have been determined for all COIs, and groundwater impacts are limited to localized regions of the FCS and are not likely to affect the FWA water supply wells because the affected groundwater is either not within or on the fringe of the capture zone for typical water supply well operations (given an average pumping rate of 1,327 gpm over the past 5 years). Furthermore, groundwater dilution calculations suggest that even if monitoring wells MW-08, MW-47, and MW-39 (the wells along the fringe of the capture zone for the 1,700 gpm pumping rate) were within the typical pumping rate capture zone, the concentrations of 1,2,3-trichloropropane in groundwater would be diluted by a factor of more than 100 by the time it reaches the supply well.

8.4 Fate and Transport Considerations for Residual Contamination

Localized areas of buried debris, contaminated soil, and contaminated groundwater remain at the FCS, but are unlikely to act as ongoing sources of contamination or to migrate to other areas or media where human or ecological receptors could be exposed for the following reasons:

- **Potential for future releases from inaccessible debris beneath buildings.** Based on the weight of evidence presented by the types of materials found in the subsurface to date at the FCS, it is unlikely that the inaccessible debris beneath the buildings contains intact drums. Even if such a drum were present, however, any liquid contained would most likely be petroleum-based. Given the low likelihood of an intact drum, and because petroleum compounds tend to have higher degradation rates and lower toxicity than do halogenated solvents, the likelihood of such a future release contributing to indoor air exposure is extremely low. In the Army's opinion, the probability that a drum full of solvent, in an intact drum, resides beneath a building is conservatively 8 in 1 million, or 8×10^{-6}.
- **Petroleum in groundwater.** Groundwater in the vicinity of Buildings 7 through 9 and at MW77 is contaminated by DRO, naphthalene, and other PAHs. However, no evidence of a floating liquid-phase hydrocarbon layer has been observed in any monitoring wells at the FCS and most petroleum-contaminated soil encountered during construction and investigation activities has been removed from the FCS; therefore, the area of affected groundwater is unlikely to expand. On the basis of the apparent age of the release and the absence of the more volatile components (such as benzene) downgradient of the apparent source, it appears that the source has been depleted of its more mobile and soluble components. In addition, because weathered diesel fuel contains relatively few volatile compounds, there is little possibility of impacts on indoor air, as evidenced by the results of subslab soil-gas sampling
- **Chlorinated solvents in groundwater.** Chlorinated solvents such as TCE and PCE were detected in soil, groundwater, and soil-gas at the FCS. Breakdown products of chlorinated solvents, most notably vinyl chloride, were also detected in groundwater, potentially indicating a naturally occurring attenuation process in progress at the FCS. Concentration gradients indicate that TCE- and PCE-contaminated groundwater appears to originate just north of Building 48 and extend northward to the FCS boundary. The relatively low concentrations of TCE and PCE are not suggestive of an extensive release, and neither chemical was detected above its PSL in a deep well located in the apparent source area. Therefore, ongoing releases from a DNAPL layer of solvent within the aquifer are not suspected and the area of impact is unlikely to expand. In addition, vinyl chloride and cis-1,2-dichloroethene are present within and downgradient of the source area, which suggests that conditions in groundwater at the FCS can be conducive to anaerobic biodegradation.
- **1,2,3-Trichloropropane in groundwater.** A zone of 1,2,3-trichloropropane-affected groundwater was identified in the eastern portion of the FCS. The chemical was presumably used as a cleaning and degreasing agent at some time in the history of operations at the FCS. The chemical breaks down slowly in groundwater. Based on passive soil-gas sample data and groundwater data for wells installed between the 1,2,3-trichloropropane plume and the

water supply wells, there is no indication of plume movement toward the water supply wells.

8.5 Explosive Hazards

The FCS was never a range, impact area, or firing point for ordnance. All munitions-related items found in the area were intermixed with large quantities of metal debris and other materials and appear to have been a very minor component of materials that were managed and disposed of in the area during historical operations. The weight of evidence provided by the munitions-related items investigations indicate that there is no reason to suspect that main-charge high explosives or explosively configured munitions were managed or disposed of during those operations. The types of munitions-related items found and observations made during detonation of the munitions-related items support these conclusion: 1) none of the munitions-related items found and observed during detonation contained main-charge high explosives; 2) artillery projectiles were filled with plaster or a similar substance; 3) bombs and bomb burster tubes were empty; and 4) none of the munitions-related items had been fused, armed, or fired. Although two rocket motors were found with propellant charges intact, such items do not represent nearly the same detonation risk as main-charge explosives like TNT or RDX.

In addition to the reasonable supposition that no high-explosive risk ever existed at the FCS, the drum and debris investigations conducted in 2007, 2008, and 2009 essentially eliminated any residual explosives-related risk that might have been present by removing large quantities of scrap metal and debris (in which some munitions-related items were intermixed) and confirming removal through geophysical surveys along the bottoms of the excavations.

The weight of available historical and empirical evidence, when considered collectively, indicates that there are neither explosive hazards associated with residential occupancy of these buildings at the FCS, nor is there reasonable likelihood of an accidental encounter with an explosively configured device in this area for the following reasons:

- Any items still remaining under building footprints will be essentially undisturbed.
- Army Garrison policies already existing at FWA are designed to prevent unsupervised encounter of any potential subsurface hazards.
- None of the technically unclassified munitions-related items, which were disposed of by detonation with excess donor charge, were fused or fired. Therefore, even if these items did contain high explosives, the likelihood of an accidental detonation, if disturbed, would be quite remote.

8.6 Human Health Risk Assessment

The HHRA was conducted in accordance with EPA and ADEC risk assessment guidance. Risks were estimated for the most plausible pathways of human exposure, based on reasonably anticipated land and water uses at the FCS. The exposure scenarios evaluated included reasonably anticipated future residential, recreational/site visitor, maintenance worker, and excavation worker receptor groups. In addition, a hypothetical unrestricted exposure scenario is evaluated assuming no action and includes conservative default assumptions regarding domestic use of groundwater and direct contact with soil to 15 feet bgs, anywhere across the site, and regardless of the existence of current or future measures precluding exposure to these media.

For the future recreational/site visitor, maintenance worker, and future excavation worker exposure scenarios, a conservative screening approach was used to select exposure concentrations, by assuming exposure occurs to the maximum detected chemical concentrations across the entire FCS. This screening approach is very conservative because it assumes that concomitant exposure to maximum levels occurs even though maximum levels are not necessarily collocated. Because of the results seen with use of this screening approach, areal averaging of data was not considered necessary. The HHRA results for these three exposure scenarios, summarized in Table 7-5, indicate that the HIs for noncarcinogenic chemicals in soil are below the EPA and ADEC threshold value of 1. The ELCR estimates are within or below the EPA target risk range of 1×10^{-6} to 1×10^{-4} and below the ADEC risk threshold of 1×10^{-5}. Therefore, no unacceptable risk is identified for these scenarios.

Residents living at the FCS under reasonably anticipated future land use conditions were evaluated for potential exposure to chemicals detected in the following three exposure media:

- Surface soil (0 to 2 feet bgs)
- Soil-gas potentially migrating to indoor air
- FWA supply groundwater currently used for domestic purposes

The multimedia HI and ELCR estimates for the future residential exposure scenario are summarized in Table 7-10. The multimedia HI for combined exposure by direct contact with surface soil, inhalation of indoor air originating from subslab soil-gas, and domestic use of FWA water supply well groundwater is below the EPA and ADEC threshold value of 1. The multimedia ELCR for combined exposure to these media does not exceed the EPA target risk range of 1×10^{-6} to 1×10^{-4} or the ADEC risk threshold of 1×10^{-5}. The results of the future residential scenario indicate that even if cumulative exposure occurs to the highest levels at any surface soil and subslab soil-gas locations, and is combined with exposure from domestic use of FWA-supplied water, HI and ELCR estimates do not exceed the EPA and ADEC risk threshold values. Therefore, no unacceptable risk is identified for the residential exposure scenario under reasonably anticipated future land use conditions. Moreover, any future exposures to soil will be further minimized by the clean soil cover (up to 2 feet) that will be placed during completion of construction at the FCS and the implementation of Army Garrison policies that are in place to preclude digging at the property.

For groundwater wells located within the hypothetical high-end pumping rate (1,700-gpm) capture zone, the ELCR from all carcinogenic chemicals in shallow groundwater samples exceeds the EPA target risk range of 1×10^{-6} to 1×10^{-4}, and the ADEC risk threshold of 1×10^{-5} in wells MW08, MW47, and MW79 (the ELCR at MW39 exceeds the ADEC risk threshold only). This ELCR is primarily a result of the presence of 1,2,3-trichloropropane at low levels (less than 2 μg/L) in these wells; however, 1,2,3-trichloropropane has neither been detected within other groundwater monitoring (sentry) wells located closer to the supply well, nor has it been detected in the supply well itself. Furthermore, solute transport calculations (Appendix B) suggest that the concentrations of 1,2,3-trichloropropane in monitoring wells MW08, MW47, and MW79 are not strong enough to adversely affect groundwater quality at the supply well.

The results of the hypothetical unrestricted exposure scenario indicate that, under the conservative default assumptions regarding domestic use of shallow groundwater and direct contact with soil down to 15 feet bgs, anywhere across the site, HI and ELCR estimates are above the EPA and ADEC target risk thresholds. These risk estimates are provided for comparative purposes to document the difference between unrestricted access versus the potential risk when considering existing restrictions that preclude digging onsite, and prevent use of shallow groundwater from areas other than the existing FWA supply wells.

An important component of the HHRA was the vapor intrusion evaluation (Appendix N) to address potential indoor exposures to future residents. The approach for evaluating vapor intrusion of VOCs into indoor air at the FCS is consistent with the tiered process recommended in EPA Vapor Intrusion Guidance (EPA, 2002), and included an evaluation of multiple lines of evidence. Based on the available monitoring data generated during the RI, all lines of evidence corroborate to support the conclusion that the vapor intrusion pathway does not represent unacceptable risk at the FCS.

Although no unacceptable risk was identified for potential exposure to soil-gas for the reasonably anticipated future land use (residential exposure) scenario, there is a potential for some residual buried debris to be present onsite (mostly underneath buildings). However, the types of materials found in the subsurface to date at the FCS suggest that it is unlikely that inaccessible debris beneath the buildings contains intact drums containing volatile liquids. Given the low likelihood of an intact drum, the likelihood of a future release contributing to indoor air exposure is considered low. To address any remaining uncertainty related to debris remaining beneath some buildings, soil gas will be retained as a medium of concern in the FS, which conservatively evaluates remedial alternatives under the hypothetical unrestricted land use scenario.

8.7 Ecological Risk Assessment

The ERA was conducted in accordance with ADEC and EPA guidance, focusing on COPECs, receptors, and areas where the greatest potential for ecological exposure might be expected. The risk to offsite terrestrial wildlife and offsite aquatic resources potentially exposed to the COPECs occurring in the drainage swale and groundwater is considered to be low. This conclusion was drawn in consideration of (1) likely infrequent use of small drainage swales, (2) their ephemeral nature, (3) the relatively low magnitudes by which COPEC concentrations exceed conservative screening levels, and (4) the expected amount of spatial attenuation, indicating that unacceptable risk to ecological populations is unlikely. Given these findings, no COPECS or areas were identified that would require additional sampling and evaluation from the drainage swale or perimeter well points to protect ecological resources potentially using the FCS.

SECTION 9

References

ADEC. 2002a. *Guidance for Treatment of Petroleum Contaminated Soil and Water and Standard Sampling Procedures*.

ADEC. 2002b. *Method AK101 for the Determination of Gasoline Range Organics.* Version 4/8/02.

ADEC. 2002c. *Method AK102 for the Determination of Diesel Range Organics.* Version 4/8/02.

ADEC. 2002d. *Method AK103 for the Determination of Residual Range Organics*. Version 4/8/02.

ADEC. 2004a. *Sediment Quality Guidelines*. March.

ADEC. 2004b. *Evaluation of Vapor Intrusion Pathway at Contaminated Sites*. Memorandum. June.

ADEC. 2007. *Draft Guidance on Multi-Increment Soil Sampling*. March.

ADEC. 2008a. *Guidelines for Data Reporting, Data Reduction, and Treatment of Non-detect Values.* Technical Memorandum 08-001. August.

ADEC. 2008b. "Oil and Other Hazardous Substances Pollution Control."

ADEC. 2009a. *Draft Vapor Intrusion Guidance for Contaminated Sites.* July.

ADEC. 2009b. *Risk Assessment Procedures Manual* (Draft). February.

ADEC. 2009c. *Ecoscoping Guidance*. March. Available at http://www.dec.state.ak.us/spar/csp/guidance/ecoscoping.pdf.

ADEC. 2010. *ADEC Risk Assessment Procedures Manual*. Division of Spill Prevention and Response, Contaminated Sites Program. July 1.

American Cancer Society. 2003. *Cancer Facts and Figures – '03*. Atlanta, Ga.

Andelman, J.B. 1990. *Total Exposure to Volatile Organic Chemicals in Potable Water*. Lewis Publishers.

Anderson, G.S. 1970. *Hydrologic Reconnaissance of the Tanana Basin, Central Alaska: U.S. Geological Survey Hydrologic Investigations Atlas*. HA-319.

ASTM (American Society for Testing and Materials). 1998. *Standard Guide for Remediation of Groundwater by Natural Attenuation at Petroleum Release Sites*. E1943-98.

ATSDR (Agency for Toxic Substances and Disease Registry). 1995. "ToxFAQS™ for 1,2,3-Trichloropropane." Fact sheet. http://www.atsdr.cdc.gov/tfacts57.html. Accessed April 27, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 1997. "ToxFAQS™ for Chloroform." Fact sheet. http://www.atsdr.cdc.gov/ tfacts6.html. Accessed April 27, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 1999a. "ToxFAQS™ for n-Nitrosodimethylamine." Fact sheet. http://www .atsdr.cdc.gov/tfacts141.html. Accessed April 20, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 1999b. "ToxFAQS™ for n-Nitrosodi-n-propylamine." Fact sheet. http://www .atsdr.cdc.gov/tfacts142.html. Accessed April 20, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 2002a. "ToxFAQS™ for DDT, DDE, and DDD." Fact sheet. http://www.atsdr.cdc .gov/tfacts35.html. http:www/atsdr.cdc.gov/tfacts35.html. Accessed April 27, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 2002b. "ToxFAQS™ for Aldrin/Dieldrin." Fact sheet. http://www.atsdr.cdc .gov/tfacts1.html. Accessed April 27, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 2003. *Public Health Assessment, Fort Wainwright, Fairbank, North Star Borough, Alaska*. September 30. http:www.atsdr.cdc.gov/hac/pha/fortwainwright/wai/toc.html. Accessed September 2006.

ATSDR (Agency for Toxic Substances and Disease Registry). 2007. "ToxFAQS™ for Heptachlor and Heptachlor Epoxide." Fact sheet. http://www.atsdr.cdc.gov/tfacts35.html. http:www/atsdr.cdc.gov/tfacts12.html. Accessed April 27, 2009.

ATSDR (Agency for Toxic Substances and Disease Registry). 2009. Minimal Risk Levels (MRLs). December. Available at http://www.atsdr.cdc.gov/mrls/pdfs/atsdr_mrls_ december_2009.pdf .

AWWA (American Water Works Associated). 2010. http://www.drinktap.org/ consumerdnn/Home/WaterInformation/Conservation/WaterUseStatistics/.

Belway, Sarah/Jacobs Engineering Group, Inc. 2009. Personal communication with Stacey Ré/CH2M HILL. April 21.

CH2M HILL. 2007a. *Addendum 1 to the Remedial Investigation Work Plan, Sound Berm Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Revision 1*.

CH2M HILL. 2007b. *Addendum 2 to the Remedial Investigation Work Plan, Soil Pile Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final*.

CH2M HILL. 2007c. *Addendum 3 to the Remedial Investigation Work Plan, Soil Gas Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final*.

CH2M HILL. 2007d. *Addendum 4 to the Remedial Investigation Work Plan, Groundwater Investigation, FWA102 Former Communications Site, For Wainwright, Alaska, Final.*

CH2M HILL. 2007e. *Interim Draft Field Sampling Plan, FWA 102 Former Communications Site, Fort Wainwright, Alaska*. October.

CH2M HILL. 2007f. *Human Health and Ecological Risk Assessment Work Plan, FWA 102 Former Communications Site Fort Wainwright, Alaska.*

CH2M HILL. 2008a. *2007 Field Data Report, Taku Gardens Former Communications Site, Fort Wainwright, Alaska*.

CH2M HILL. 2008b. *Draft Preliminary Risk Screening Evaluation Report, Taku Gardens Former Communications Site, Fort Wainwright, Alaska*.

CH2M HILL. 2008c. *Interim Draft Remedial Investigation Management Plan*.

CH2M HILL. 2008d. *Revised Interim Draft Remedial Investigation Work Plan, FWA 102 Former Communications Site, Fort Wainwright, Alaska*.

CH2M HILL. 2008e. *Standard Operation Procedure*.

de Voogt, P., and U.A. Brinkman. 1989. "Production, Properties and Usage of Polychlorinated Biphenyls." In: R.D. Kimbrough and A.A. Jensen, eds., *Halogenated Biphenyls, Terphenyls, Napthalenes, Dibenzodioxins, and Related Products*. Amsterdam: Elsevier/North-Holland Biomedical Press. Pp. 3–46.

DeGrandchamp, Richard L., and Mace G. Barron. 2005. *PCB Analysis and Risk Assessment at Navy Installations*. *Part A: Overview of PCB Mixtures*. Prepared for Navy Environmental Health Center.

Ecology and Environment, Inc. 1993a. *Final Management Plan, Operable Unit 5, Fort Wainwright, Fairbanks, Alaska*. April.

Ecology and Environment, Inc. 1993b. *Soil and Groundwater Assessment, Additional Underground Storage Tank Sites, Fort Wainwright, Fairbanks, Alaska*. Prepared for the U.S. Army Corps of Engineers, April.

Ellis, L., and S. Anderson. 2006. Anaerobic Tetrachloroethene Graphical Pathway Map. March.

EPA. 1986. *Guidelines for Carcinogen Risk Assessment*. *Federal Register*. Vol. 51, 33992–34013. September 24.

EPA. 1989. *Risk Assessment Guidance for Superfund, Volume I – Human Health Evaluation Manual, Part A* (Interim Final). EPA/540/1-89/002. Office of Solid Waste and Emergency Response. December.

EPA. 1991a. *Risk Assessment Guidance for Superfund*. Vol. I: Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. OSWER 9285.6-03. March 25.

EPA. 1991b. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*. OSWER Directive 9355.0-30. April 22.

EPA. 1992. *Supplemental Guidance to RAGS: Calculating the Concentration Term*. Publication 9285.7-081. Office of Solid Waste and Emergency Response. May.

EPA. 1996. *Soil Screening Guidance: Users Guide*.

EPA. 1997a. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*. Interim Final.

EPA. 1997b. *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund.*

EPA. 1997c. *Health Effects Assessment Summary Tables (HEAST) FY 1997 Update*. July.

EPA. 1997d. *Exposure Factors Handbook*. Vol. I: General Factors. EPA/600/P-95/002Fa. August.

EPA. 1998. *Guidelines for Ecological Risk Assessment*.

EPA. 2001. *Health Assessment Document for Trichloroethylene Synthesis and Characterization* (External Review Draft). EPA/600/P-01/002A. Office of Research and Development, National Center for Environmental Assessment, Washington Office, Washington, DC.

EPA. 2002. *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*. EPA 530-D-02-004. Available at http://epa.gov/osw/hazard/correctiveaction/eis/vapor.htm

EPA. 2003. Memorandum—*Human Health Toxicity Values in Superfund Risk Assessments*. OSWER Directive 9285.7-53. December 5.

EPA. 2004a. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual Part E, Supplemental Guidance for Dermal Risk Assessment.* EPA/540/R/99/005.

EPA. 2004b. *Final Five-year ROD Review Report, Eielson Air Force Base, Alaska*.

EPA. 2004c. *Integrated Exposure Uptake Biokinetic Model for Lead in Children. (IEUBK)*.

EPA. 2005a. *EPA Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens*. Risk Assessment Forum, Washington, DC. EPA/630/R-30/003F. Available at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=160003.

EPA. 2005b. *Guidelines for Carcinogen Risk Assessment.* EPA/630/P-03/001F.

EPA. 2008. *Brownfields Technology Primer: Vapor Intrusion Considerations for Redevelopment*. EPA 542-R-08-001. March.

EPA. 2008a. *Integrated Risk Information System, Glossary of Terms*. Office of Research and Development. Accessed September 2008. Available at http://www.epa.gov/iris/help_gloss.htm#content 36.

EPA. 2009a. *Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites.* December.

EPA. 2009b. *Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual Part F, Supplemental Guidance for Inhalation Risk Assessment*.

EPA. 2009c. National Recommended Water Quality Criteria. Office of Water. http://www.epa.gov/ost/criteria/wqctable/

EPA. 2009d. *IRIS Toxicological Review of Trichloroethylene.* (External Review Draft). EPA/635/R-09/011A. Washington, D.C.

Hemker, C.J., and G.J. Nijsten. 1996. *Groundwater Flow Modeling Using Micro-Fem*: Version 3. Elandsgracht 83-1016 TR. Amsterdam, The Netherlands.

HLA (Harding Lawson Associates Group, Inc.). 1996. *Operable Unit 5, Remedial Investigation Report, Fort Wainwright, Alaska*. Prepared for U.S. Army Corps of Engineers, Alaska District.

HLA (Harding Lawson Associates Group, Inc.). 1997. Postwide Risk Assessment, Fort Wainwright, Alaska. Volume 1. Prepared for U.S. Army Corps of Engineers, Alaska District.

Hodge, R.P. 1976. *Amphibians and Reptiles in Alaska, the Yukon, and Northwest Territories*. Alaska Northwest Publishing Company. Anchorage, Alaska.

ITRC (Interstate Technology & Regulatory Council). 2007. *Vapor Intrusion Pathway: A Practical Guideline.* VI-1. Washington, D.C.: Interstate Technology & Regulatory Council, Vapor Intrusion Team. Available at www.itrcweb.org.

Jacobs (Jacobs Engineering Group, Inc.). 2007a. *Former Communications Site PCB Removal Action, Final.* August.

Jacobs (Jacobs Engineering Group, Inc.). 2007b. *Munitions and Explosives of Concern Support Work Plan*. September.

Jacobs (Jacobs Engineering Group, Inc.). 2008. *Work Plan, Former Communications Site Drum and Debris Removal Investigation*.

Jacobs (Jacobs Engineering Group, Inc.). 2010. *2007/2008/2009 Former Communications Site Drum and Debris and PCB Investigation Report*. January.

Kerns, J.D. 1993. *Descriptive Inventory of Wildlife and Vegetation, Operable Unit 3. Environmental Resource Division, Fort Wainwright, Alaska*. September.

Lenz, Julia/Alaska Native Heritage Program. 2009. Personal communication with Stacey Ré/CH2M HILL. March 11.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology*. Vol. 39:20-31.

McHugh, T.E., D.E. Hammond, T. Nickels, and B. Hartman. 2008. Use of Radon Measurements for Evaluation of Volatile Organic Compound (VOC) Vapor Intrusion. *Environmental Forensics*. Vol. 9, pp. 107-114.

National Academy of Sciences. 1989. Recommended Dietary Allowances.

Nelson, G.L. 1978. *Hydrologic Information for Land Use Planning, Fairbanks Vicinity, Alaska*. U.S. Geological Survey Open File Report 780959.

NOAA (National Oceanic and Atmospheric Administration). 2009. *Screening Quick Reference Tables.* NOAA OR&R Report 08-1. Office of Response and Restoration Division, Seattle, Washington.

North Wind, Inc. 2005. *Draft Sampling Data Report, Taku Gardens and Building 3421*. Prepared for U.S. Army Corps of Engineers. May.

North Wind, Inc. 2006. *FWA-102 Former Communications Site (Taku Gardens) Field Data Report, Fort Wainwright, Alaska*. February.

North Wind, Inc. 2007. *Preliminary Source Evaluation II Report Taku Gardens, Fort Wainwright, Alaska (Final).* Prepared for Department of the Army, U.S. Army Corps of Engineers, Alaska District, Elmendorf Air Force Base, Alaska. May.

Oasis (Oasis Environmental, Inc.). 2007. *Preliminary Source Evaluation 1 Narrative Report, Former Communications Site, Fort Wainwright, Alaska, Interim Final*. Prepared for Department of the Army U.S. Army Corps of Engineers, Alaska District, Elmendorf Air Force Base, Alaska. March.

ORNL (Oak Ridge National Laboratory). 2009. *Oak Ridge National Laboratory Risk Assessment Information System*. http://raisornl.gov/cgi-bin/tox/TOX_select?select =chem. Accessed April 2009.

Pewe, T.L., J.W. Bell, R. Forbes, and F.R. Weber. 1976. *Geologic Map of the Fairbanks D-2 SW Quadrangle, Alaska*. U.S. Geological Survey Miscellaneous Investigations Series Map I-829-A.

R&M (R&M Consultants, Inc.) 2004.*Geophysical Site Investigations, Family Housing Replacement, Taku Sites FTW251 & FTW283), Fort Wainwright, Alaska*. Final. Prepared for U.S. Army Engineer District, Elmendorf Air Force Base, Alaska. July.

Sage Earth Sciences. 2007. Taku Gardens—Geophysical Survey 07-2006. (Presented as Appendix B in North Wind, Inc., 2007, *Preliminary Source Evaluation II Report, Taku Gardens, Fort Wainwright, Alaska* (Final). January 25.)

Selkregg, Linda. 1976. *Alaska Regional Profiles*. Vol. VI, Yukon Region. University of Alaska. Arctic Environmental Information and Data Center.

Sloan, C., and R. Van Everdingen. 1988. *The Geology of North America*. Vol. 0-2, Hydrology Region 28, Permafrost Region.

Spindler, M.A. 1976. Ecological Survey of the Birds, Mammals, and Vegetation of the Fairbanks Wildlife Management Area. Master's thesis, University of Alaska. December.

U.S. Army Garrison, Alaska. 2006. *Integrated Natural Resources Management Plan: Fort Wainwright.*

U.S. Army Garrison, Alaska. 2007. *Action Memorandum for a Department of Army Time-Critical Removal Action at the Communications Site (a/k/a Taku Gardens Housing Expansion Area), and Imposition and Maintenance of Interim Land Use Controls Fort Wainwiright National Priorities List (NPL), Federal Facility Site, Fort Wainwright, Alaska* November 19.

U.S. Army. 2004. Explosive Ordnance Incident Report Forms 176-018-04, 176-24-04, 176-21-04, 176-27-04, and 176-8-05.

U.S. Army. 2005a. Fort Wainwright Town Hall Meeting Information, "Contamination Fact" on Substance Found in the Taku Gardens Vicinity, Press Release. August 30.

U.S. Army. 2005b. Fort Wainwright Town Hall Meeting, Taku Gardens Housing Expansion. September 6.

USACE. 1991. *Groundwater Monitoring Network, Fort Wainwright, Alaska*. U.S. Army Installation Restoration Program. August.

USACE. 1994. *Background Data Analysis for Arsenic, Barium, Cadmium, Chromium, and Lead on Fort Wainwright, Alaska*.

USACE. 2004a. *Chemical Data Report Foundation Study HTRW Survey, Replace Family Housing (FTW-251), Fort Wainwright, Alaska*. April.

USACE. 2004b. *Chemical Data Report Foundation Study HTRW Survey, Replace Family Housing (FTW-283), Fort Wainwright, Alaska*. April.

USACE. 2004c. Geotechnical *Findings Report, Family Housing Replacement— —Taku Gardens Site, Fort Wainwright, Alaska (FTW251)*. March.

USACE. 2004d. *Geotechnical Findings Report, Family Housing Replacement—Taku Gardens Site, Fort Wainwright, Alaska (FTW283)*. March.

USACE. 2006. Former Communication Site Preliminary Source Evaluation, Site Preparation, Early Utility Construction, and Limited Debris Removal Photographs.

USAED (U.S. Army Engineer District). 2007. *Replacement Housing Fort Wainwright Specification 02300, Earthwork.*

USAED (U.S. Army Engineer District). 2008. *Munitions and Explosives of Concern Support Work Plan, Former Communications Site RI/FS, Fort Wainwright, Alaska, Final*. (August)

USAED (U.S. Army Engineer District). 2009a. *Taku Gardens Sound Berm Additional Sampling Locations*.

USAED (U.S. Army Engineer District). 2009b. *Taku Gardens PCB Area Foundation Demolition. Technical Memorandum*.

USAED (U.S. Army Engineer District). 2009c. *Taku Gardens: Investigation of the 1,2,3-TCP Plume*.

USGS. 1988. *Element Concentrations in Soils and Other Surficial Materials of Alaska.* USGS Professional Paper 1458.

USGS. 1996. *Numerical Simulations of Ground-Water/Surface-Water Interactions at Fort Wainwright, Alaska*. Draft Report.

USGS. 2001. *Ground-Water Studies in Fairbanks, Alaska—A Better Understanding of Some of the United States' Highest Natural Arsenic Concentrations.* USGS Fact Sheet FS-111-01.

Western Regional Climate Center. 2009. Fairbanks WSO Airport, Alaska (502968): Monthly Climate Summary, 9/1/1949 to 12/31/2005. http;//www.wrcc.dri.edu/cgi-bin/cliMAIN .pl?akfair. Accessed March 23, 2009.

Appendixes

APPENDIX A

2007 Amendment to the Federal Facilities Agreement

Click this page to open Appendix

APPENDIX B

Capture Zone Modeling Information and Water Supply Production Data Sheets

Click this page to open Appendix

APPENDIX C

Historical Aerial Photographs and Maps

Click this page to open Appendix

APPENDIX D

2007/2008/2009 Former Communications Site Drum And Debris And PCB Investigation Report

Click this page to open Appendix

APPENDIX E

RI Field Data and Sampling Records

Click this page to open Appendix

APPENDIX F

2007, 2008, and 2009 Data Quality Evaluation Reports and Third Party Data Review Report

Appendix F consists of the Data Quality Evaluation (DQE) reports, and ADEC sample checklists for the Remedial Investigation sampling activities conducted at the FCS in 2007, 2008, and 2009 and the report from a third party data review conducted by the Army Corps of Engineers.

APPENDIX G

Analytical Data Processing Information

APPENDIX H

Explosives Safety Submission

Appendix H consists of the summary statistics tables that document whether the method detection limits (MDL) for each pre-RI and RI study were adequate to detect the target analytes at concentrations consistent with the project screening levels being used for the RI; that is, whether the MDL was low enough to conclude that the analyte was not present at levels that might pose potential risk (assuming the conservative exposure scenarios of the PSLs) if an analyte was not detected in any samples.

Data usability was evaluated by investigation and medium. To accomplish the usability evaluations, data for each investigation and medium were consolidated into summary statistics tables that list the following for each analyte: number of samples analyzed, number of detects and non-detects, minimum and maximum detected values, minimum and maximum MDLs for non-detects, the PSL, and the number of non-detect results with MDLs greater than the PSL.

APPENDIX I

Analytical Data Tables

Appendix I is made up of two parts:

- Part 1 identifies the samples used to evaluate the nature and extent of contamination at the FCS:
  - Table A lists the samples used to characterize possible source material at the FCS.
  - Table B lists the samples used to evaluate the nature and extents of contamination in surface soil at the FCS
  - Table C lists the samples used to evaluate the nature and extents of contamination in subsurface soil at the FCS
  - Table D lists the samples used to evaluate the nature and extents of contamination in groundwater at the FCS
  - Table E lists the samples used to evaluate concentrations of contaminant in soil gas at the FCS

  The sample locations where multiple results were combined into single results (in accordance with the decision rules described in Appendix G) are indicated by yellow-highlighting.

- Part 2 provides full listings of the available analytical results for all samples included in the database maintained by CH2M HILL. This database contains results for samples collected during pre-RI, 2007 RI, 2008 RI, and 2009 field activities, and includes results for samples used for source characterization, nature and extent of contamination, and risk assessment evaluations, as well as results for samples that were not evaluated during the RI, either because they do not represent current conditions, or are from media that are not evaluated in the RI (e.g., wipe samples from equipment). Since only one result per location per depth (or sampling event, in the case of groundwater and soil gas) per analyte could be used in the nature and extent and risk assessment evaluations results for multiple samples collected at the same location and depth (for example normal and field duplicate samples) are represented by single columns of results in the tables. Tables A through E indicate the sample identification numbers for locations and depths (or sampling event) that are combined in the data listings. The analytical data tables are organized as follows:
  - Soil sample results tables (Tables 1-1 through 1-6) are organized by investigation, location, and depth, with source, surface and subsurface soil samples included in the same tables so that possible vertical trends can be observed. The evaluation group for each sample is identified in the sample heading. Bold font and shading indicate samples and results with exceedances of the project screening levels.
  - The groundwater sample results table (Table 2-1) is organized by location and sampling date so that results for wells sampled multiple times are located next to one another. The evaluation group for each sample is identified in the sample headings. Bold font

and shading indicate samples and results with exceedances of the project screening levels.

– The soil gas sample results tables (Tables 3-1 through 3-4) are organized by location type (vadose, subslab, ambient air) and sampling date so that results for locations sampled multiple times are located next to one another.

– The wipe sample results table (Table 4-1) and the waste sample results tables (Tables 5-1 through 5-3) are organized by investigation.

APPENDIX J

EOD Response Reports

APPENDIX K

Soil Arsenic Background Evaluation

APPENDIX L

Explosives Safety Submission

APPENDIX M

Risk Assessment Calculations and Ecoscoping Form

APPENDIX N

Overview of Vapor Intrusion Pathway Evaluation

APPENDIX O

Response to Comments Received from the EPA and ADEC on the *Draft Remedial Investigation Report FWA 102 Former Communications Site Fort Wainwright, Alaska*

APPENDIX P

2010 DDT Investigation Results

APPENDIX Q

January 2010 Subslab Soil Gas and Ambient Air Sample Information

APPENDIX R

July 2010 Subslab Soil Gas and Ambient Air Sample Information

APPENDIX S

Building Floor Plans and Subslab Soil Gas and Ambient Air Sampling SOPs